THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S).

1909 EDITION

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THE ASPIRATION OF THE GERMAN.

IN our last issue, in the City columns, we dealt at some length with the subject of English finance and German machinery. It is clear that those interested in German manufacturing are fully alive to the situation, and probably realise as well as anybody can tell them, that, if a proper understanding is arrived at between the financial and industrial interests in this country, we shall be properly and adequately equipped to combat the forces which are slowly gathering together for one purpose—and we have every appreciation of the seriousness of the statement—the crushing out of the British electrical industry. We do not suggest that the controllers of the German electrical industry are actuated by any feelings of vindictiveness against us, but we do say that the policy of German expansion can never be properly realised until the British manufacturer is so reduced in pocket and in spirit as to be unable to offer any fight whatsoever. The reason which impels us to again refer to the antagonistic interests of the two countries is the attitude taken up by the *Elektrotechnische Zeitschrift* in its issue of March 25th, which is shown in the following extract:—

Elektrotechnische Zeitschrift, No. 12, 1909.

Apparently the English electrical industry is not in a particularly happy position. We refer in this connection to the statements made in the *E.T.Z.* for 1908, page 328. Whether the new English patent legislation with its protection for home industry will help it forward is an open question. It is peculiar for Mr. Kerr to have appraised as a great stimulation for the English electrical industry the fact that it could make sure of the order for the tramcars which the Moscow municipality had to give out in 1907. As if it were not known that this order went to London on account of financial and not technical considerations! And it is as peculiar for Mr. Kerr to complain that the millions of English capital sent abroad and invested in industrial undertakings result in orders and work for German and American factories, and for him to beg the big financial houses to display more patriotism by arranging for English works to get such orders. Mr. Kerr has done the British capitalist public wrong. It is exclusively better conditions and better execution which send the orders to other countries.

On the face of it, our contemporary's remarks might appear to be *apropos* of nothing, for the statement of the Chairman of the British Company alluded to was made many months ago, and we presume it is being served up again in order to give the *Elektrotechnische Zeitschrift* an opportunity of saying that the reason why English capital is finding its way to German workshops is by reason of superior manufacture. This is a perfectly frank statement, though we have heard it before; indeed, a writer signing himself "Anti-Humbug," unburdened his soul to the like purpose in the *Westminster Gazette* last week. Our German contemporary, however, is somewhat hampered by its official connection with German electrical interests, and is in consequence either slightly biassed, or does not know exactly what is happening outside its official circle. In order, however, that there should be no misconception in future, we propose to make some points clear in regard to the comparative

merits of electrical machinery made at home and abroad. Before doing so, however, we will deal in detail with the foregoing extract. The ordinary reader might presume that the Moscow municipality had placed an order in London solely on account of a financial arrangement and quite irrespective of whether the machinery was good, bad or indifferent. It is true that a municipal loan was raised in London, but it is equally true that when the municipality divided an order for electrical plant between Germany and this country, it was not till after the most searching inquiries had been made into the technical ability of the English firm. We are prepared to admit that the St. Petersburg episode may have had its influence, and in case our contemporary has forgotten or has not heard of the incident, we would refer it to the St. Petersburg Press of early last year, which made strong protests against the treatment of the same British firm which secured a portion of the Moscow order. There can be no shadow of doubt that if St. Petersburg municipality, when placing its order for electric tramway equipments had been uninfluenced by extraneous considerations, the Germans would have been completely ousted. For what are the facts; the lowest tender was Dick, Kerr's, and apparently the offer was one which could not be disregarded, for a special technical Committee was formed to consider the various details of the equipments, and as a result of a protracted investigation a unanimous recommendation in favour of the English tender was made. Notwithstanding, however, the complete vindication of the quality of British-made machinery, the municipality, influenced by underground methods, gave the contract to Germany by a narrow majority. The local Press did not hesitate to condemn the action in strong, if not libellous, language. The necessity of referring to such incidents is to be regretted, but we are getting a little tired of the constantly recurring remarks concerning the alleged superiority of German-made machinery, and it is just as well now and again to thoroughly examine some of these alleged claims. In making these comments we in no wise desire to depreciate the splendid work which Germany has done in the development of electrical science. For a long time she led the world, and we have still sufficient faith in the scientific methods pursued in Germany to assume that they will give birth to further epoch-making inventions.

In the application of electricity to industrial operations, it is undoubted that exceedingly fine work has been accomplished in Germany, and it was not surprising that in the use of electric driving in collieries, in steel works, factories, &c., a good deal of the original machinery in this country was German-made, and while we do not ourselves consider the British manufacturer was so much behindhand as many would have had us believe, there is now a complete consensus of opinion that on the score of merit there is no longer any necessity to go to the Continent, and in the discussion at the Institution of Electrical Engineers on Mr. J. H. Rider's paper, this point has been amply demonstrated by more than one speaker. In the commercial development of electrical science, therefore, this country has nothing to learn except one thing, and that is the art of combining finance and industry in such a way that it will be possible for the British manufacturer to compete with Germany in its own territory. We have always held the opinion that until the electrical industry can forge a weapon by which it can strike the foreigner on his own hearth, there will be no peace at home, and it is no exaggeration to state that when the British manufacturer starts work on the European Continent he will have started a new era of prosperity for himself. These columns have, time after time, borne witness to the great demand for electrical machinery which exists in Russia, Italy, Austria, and other European countries, and the unforgettable fact concerning this work, is the remunerative prices which are obtained. Moreover, the experience of years shows clearly that the Continental buyer has abundant confidence in British machinery, and we firmly believe that if the Continent were adequately cultivated, neither tariffs nor the ramifications of German banking could keep us out.

JAPAN AS AN ELECTRICAL MARKET.

The rapid growth of electrical business in Japan has recently formed the subject of an American Consular report, in which the "wonderful" electric railway development, as well as the growing demand for electrical supplies, are reviewed.

The forward movement in electric tramway traction in this country is generally dated from the opening of the Bristol lines in 1895, and it was in that same year that Japan saw the starting of its first line, some eight miles long, in the city of Kioto, where a national industrial exhibition was then being held. Since that date, we read, every Japanese city of any importance has constructed electric tramways as convenient methods of short-distance communication, and the result of this is that there are 16 companies, with an aggregate capital of about £8,000,000, working 165 miles of system and constructing a further 100 miles, while 15 more companies (capital £3,000,000) have not yet got to work. In the year 1907 the 16 companies carried 183 millions of passengers, had receipts aggregating nearly £800,000, and paid a dividend of about 7 per cent.

The English electric tramway companies that are earning such a dividend are few indeed—doubtless that is partly because municipal authorities own the "plums" that would be the most comparable with the Japanese undertakings; we can trust the enlightened Japs to see to it that their private enterprises are left free from unfair and persecuting limitations and obstructive stipulations. But there are other causes which have hindered tramway finance in England beside these factors, and although the dividend in Japan was a satisfactory 7 per cent. for 1907, this may not continue, for we read that "there has been a gradual decrease in dividends due to large flotations of stock." There seems to be an inevitable danger of over-doing things, and spoiling a successful comparatively small concern, or what contained the possibilities of becoming so, by pushing out too far into new districts, where traffic is expected to grow at some time or other, thus decreasing the profit-earning power of the whole system unless, or until, vacant spaces be built upon and populated. Estimates of future growth have not always been realised, and we venture the opinion that there would be a greater percentage of profit shown on the capital that was put into many of our own undertakings had estimators been less sanguine and their estimates less extravagant, and had the general trade in some centres been sufficiently progressive to require new building operations. We do not know, from the report before us, how far the Japanese dividend reductions have been due to a similar cause, but our Far Eastern friends might learn some lessons from these islands in the West. We hope, for the sake of future tramway developments, in which the British manufacturer desires to share some of the benefits, that the 7 per cent., or a little less rate, will be maintained.

Turning now to electric lighting, in this department, as in tramways, there is good development reported. Some 76 companies, with a capital of about £3,000,000, are operating in the chief Japanese centres of population; and of the imports of electric light apparatus and instruments and motors, by far the larger proportion is obtained from the States. The imports of electric motors slumped heavily in 1906, falling from just under £250,000, the figure for 1905, to £140,000. The American share fell from £186,000 to £86,000—or from about 75 per cent. of the total to 61 per cent. Elsewhere in the report, we find that the United Kingdom increased the electrical machinery sent through Kobe from £14,500, in 1906, to £17,000, while the United States experienced a fall in dynamos and motors from £36,000 to £15,000. In the first 10 months of 1908, the imports through Kobe of dynamos and motors were £30,000 (United States, £11,400; Great Britain, £8,700), and of electrical machinery £69,000, the United States sending only £35,000. The Consul points out that the United States has taken the lead from the start in the sale of all kinds of electrical supplies in Japan, "of which," he proceeds, "there can be no doubt of its ability to

maintain." This confidence in regard to the future is quite American—we do not mind it, for it is sometimes the forerunner of a too-satisfied attitude which denotes weakness. No one denies the favoured position of the States geographically, but the figures that are given above show that there is some life in the British dog yet, and the States will not be permitted by the British electrical exporter to have things all their own way, or we mistake the present humour of some of our firms. The report mentions a point that has been brought out in these pages more than once, that people that have shown such initiative and enterprise as have our allies in the Far East, are not going to be satisfied with importing. "In the course of time Japan will certainly make strenuous efforts, as in any other form of manufacturing, to produce its own electrical machinery." It has, as we have already shown, made important efforts of this character for a good many years past, but it has so much scope for electrical application in the course of its anticipated progressive development, that it will be impossible for it to be anything like independent for quite a long time to come. It is thought by some students of these Far Eastern countries that in years to come Japan, when she has reached a position of greater manufacturing ability, will have much to do with the provision of the vast electrical needs that are bound to come in China as the latter's at present undeveloped or unserved enormous stretches of territory, and numerous centres of large populations, come more and more under the influence of Western ideas and the development and modernising that are bound to ensue. That may be looking a long way ahead, but it is a point to consider. British and American electrical men may assist the Japanese in erecting their manufactories for meeting their own needs in the meantime, but in addition to this China is a "Continent" to nurse electrically for ourselves. In the negotiation of railway concessions and financial coups we may have slim rivals in Germany, who commit breaches of conventions, as we have lately witnessed from reading our daily newspapers; but if only we have on the part of our exporting manufacturers a far-seeing grasp of the possibilities, on the part of financial authorities in this country a more reasonable backing of industry, a wisely selected agency representation, and on the part of travelling representatives a more enlightened salesmanship ability, British electrical quality will stand us in good stead, and we shall yet do well. China is a field which may not all at once yield a particularly profitable return in actual orders, except as a consequence of concessions obtained by promoters or financial groups.

It remains only to once more emphasise a fact that we have previously stated, and that is again driven home by the American Consul whom we quote, namely, that there is a growing field there demanding our commercial energy in exploiting electrical supplies. It is foretold that in a few years the chief commercial cities of the Japanese Empire will be linked together by a complete network of electric tramways, and the consummation of this idea, as well as all the other prospects of electrical development, should create a substantial demand in which the British manufacturer may win perhaps a bigger share than the confident American Consul predicts, if he determinedly and unceasingly devote himself to the task.

The Depletion of Natural Resources.

A CONFERENCE was held in Washington last year, at the instance of President Roosevelt, for the purpose of discussing the conservation of the natural resources of the United States; and the President of the American Association for the Advancement of Science, who was invited to take part in the conference, recently published his views in *Science*, the organ of his Association.

It is a depressing picture that President Howe draws of the state of his country. The forests have almost disappeared, and it is estimated that the remainder will furnish lumber for only another 35 years. Limitless as the coal supply at first appears, the immense drain from use and waste is having its effect. The prosperity of an industrial centre such as Pittsburg depends on the proximity of a supply of suitable coal, and the State geologist of West Virginia, basing his estimates on the present rate of consumption, considers that at the beginning of next century there will be no coal within a hundred miles of Pittsburg. Of the whole original supply of iron ore in the States, suitable for working with present methods, one-thirteenth has already been used, and the whole will be exhausted before the end of the present century.

On the other hand, something has already been done, and more may be done, to save the situation. A considerable saving in timber, and also in steel, and hence in iron ores, is hoped for from an extended use of reinforced concrete for structural work. It is to be regretted that our own Local Government Board assumes, in connection with loans on municipal buildings, a distinctly discouraging attitude towards this method of construction. The experiments of the Technologic Branch of the United States Geological Survey, founded in 1903, have shown that much of the fine coal, treated by the mines as refuse, is, when made into briquettes, as valuable as the finest coal obtained. It is found also that many non-coking coals can, by proper methods, be coked as readily as the best coking coals of Pennsylvania. More remarkable still are the results of investigations in the use of coal in the gas producer and gas engine. Not only does a steam coal develop about two and a half times as much power when employed in the producer and gas engine as when used under a boiler, but a lignite, worthless as a steam coal, was found when turned into gas to develop 0·30 H.P. per pound per hour, whilst the best Pocahontas coal used under a boiler developed only 0·28 H.P.

In the United States, as in this country, the possibilities of water-born transportation are greatly neglected. This should be remedied, as "by substituting water transportation for rail transportation the saving in steel is very great, for the same load can be carried by the former with one-third the steel in the original plant that is necessary when loads are carried by rail." To effect a further saving in iron ores, improvements must be introduced into their treatment which will make it possible to utilise the low-grade ores at present of no value, and we must hope also for "the discovery of new alloys which will make it possible to obtain the present strength for machines and structures with the use of less material, thus decreasing the amount of ore used."

We cannot agree with President Howe that it is to the engineer alone that we must look for all such advances in knowledge and improvements in technical processes and material as he requires. Many must come in the first place from the chemist, although doubtless the engineer will have much to do with their utilisation. But in any case, it is high time for us to follow the lead of the United States, and take serious steps to save what remains to us of our inheritance of natural resources. The country which has exhausted its natural resources and can manufacture only on condition of importing all raw material is industrially dead. To avoid such a fate will require the united efforts of Governments, manufacturers and scientifically-trained technologists of all branches.

Differences between English and Foreign Tenders for Colonial Work.

EARLY in the year some discussion took place in New Zealand, in which the interesting question that demanded consideration was what margin of difference between German and British tenders there might be on a total contract of £13,000 to enable British Colonials to give the preference to a firm in the Home Country. The tenders were for 12 electric cranes required by the Auckland Harbour Board. The lowest tenderer was a German firm, which quoted £13,160, but there was one from Messrs. Babcock and Wilcox at £13,460. If that "4" had been a typist's slip for "1," we suppose there would have been no question raised as to which course the contract would take—the difference in the tariffs would then have been ignored probably—but £300, being 2·2 per cent. of the total, was considered to be sufficient to justify a recommendation by the chairman, the Hon. E. Mitchelson, that the German firm be given the work, as "members of the Board had to remember that, having control of public funds, they had *a right* to accept the lowest tender, and must not be influenced by any sentiment of preference for England, Ireland, or Scotland . . . . the Board was satisfied that the German firm would fulfil the provisions of the contract . . . . he

would have preferred to have recommended the acceptance of an English firm's tender, but they were dealing with public money, and had their duty to do."

We are glad to find that there was a successful protest against this indifferent attitude, for we remember that whatever may be the predilections of members of the Harbour Board, New Zealand's general policy has been to afford every possible opportunity to British producers to supply her requirements. We wish the hon. gentleman had not referred to that personal preference of his to send the work home to us, or to the mere *right* to accept the lowest tender, for seeing that he is in a part of the world where the position of the working man and his wages are very satisfactory, we should have thought that the difference in the conditions under which workmen in Germany and the United Kingdom work and live, would have carried a pretty considerable weight. What seems to have gone a long way in deciding the opinion of the honourable gentleman, is the duty to be paid on the importation, which would be higher on goods from Germany than on those received from England; so that while the work would go to Germany, a few hundred pounds—the difference in the tenders, plus the difference in the tariff—would go into the pocket of the New Zealander. Rather than send the work to this country, so that our workmen may be employed, and so that there may be this additional wealth available in the nation at home, they prefer to find comfort in the tariff while their own New Zealand Government promise us a Dreadnought. We are all of us proud of the Dreadnought offer, but we should also like contract matters of this kind to be regarded in a little larger spirit than is evidenced by talking thus concerning a total difference of £500, and giving £13,000 of work to a nation whose naval preparations are the cause of our needing the additional Dreadnoughts.

There were two meetings of the Board held to consider the matter. At the first the recommendation of the Hon. E. Michelson was rejected, for, from the point of view of practical patriotism, there was a good deal of more or less heated argument from other members, one speaker pointing out that the Germans are "our" greatest commercial rivals, and another appealing that, as the Harbour Board raised its money at home, it was only fair to give work of the kind under attention to British firms if it was possible to do so. We notice that the British Board of Trade representative journeyed all the way from Wellington to see members on the subject, and that the hon. gentleman named had been interviewed, though which way the representative's influence went we are not sure. One of the speakers described it as "commercial dishonesty" to ask German firms to tender against British firms, and then to refuse to accept the lowest quotation. Here we do not agree. Public authorities in this country often stipulate, "The Council does not bind itself to accept the lowest or any tender." Further, at home we insert restrictive labour clauses, which, while they hamper the manufacturer in securing contracts in competition, give our people an opportunity to live under more decent conditions, and to work shorter hours, than obtain in countries which are our manufacturing rivals. The British tenderer has his factory working under such regulations, and the work he does, whether it be for home or foreign consumption, has to be carried through under the same labour conditions. German conditions may be very different, and we think, before such terms as "commercial dishonesty" are used, some thought should be given to such words as "other things being equal." Now, a difference of this kind we should have thought would appeal to such a people as are living in New Zealand, and in view of the general spirit of loyalty and patriotism for which New Zealand has always stood out so magnificently, the pro-German attitude of so many members of the Harbour Board quite passes our comprehension. The probability of those who find this public money regarding the placing of the contract at home as "commercial dishonesty," strikes us as being a very remote thing indeed. Rather should we think them more likely to resent the indifference to the well-being of the old folks at home if the contract had been placed abroad.

At the first Auckland meeting, the amendment favouring the lowest British tender was carried, only three votes being recorded in the negative, but a few days later a second meeting followed. Here, after a similar discussion, a motion to refer the British recommendation back to the Committee, was lost by 7 votes to 6, and eventually it was resolved to defer the matter to the next meeting in order to take legal advice "whether the Board could be restrained under injunction from accepting the tender" of the British firm. On that point, of course, in the absence of all the documents relating to the matter, we are not able to express an opinion. News as to the ultimate issue has not yet reached us, but we think that the foregoing notes will be of interest to the electrical and engineering trades in this country who have transactions with our Australasian and other Colonies.

The Trade Boards Bill.

In our last issue we commented on the provisions of the Trade Boards Bill in an article on "A Legal Minimum Standard of Wages," and drew attention to certain points to which objection might fairly be taken. We have now received from the "Employers' Parliamentary Council" a copy of a memorandum addressed by this body to the President of the Board of Trade, in which are set out some of the grounds on which the Council object to this Bill. It is interesting to note that the principal objections named in this memorandum are very similar to those indicated by us, as it is stated that the value of the articles produced in the scheduled trades is determined by unrestricted competition rather than by the cost of wages and material; and that the average rate of profit in the so-called sweated trades is not materially higher than the average rate of profit in trade generally. From this it is argued that an increase of wages must be accompanied by an increase in the selling price of the articles produced; and that this rise of price would, owing to foreign competition, tend to bring about the extinction of these particular trades in this country.

It is also contended that the enforcement of a standard minimum wage would, in another way, defeat the object with which the Bill is brought forward, which is to improve the condition of the lowest-paid workers; as employers would not continue to employ persons who, in their opinion, were not worth the higher wage. This would lead to the discharge of a considerable number of the older and less competent workpeople, who are also the ones who would find it most difficult to get other employment; and the fixing of a minimum wage would also tend to keep all wages down to this minimum, as the employer would probably try to make the more competent workpeople make good any loss he incurred by having to pay the higher wage to the less competent ones.

The other provision to which great objection is taken in this memorandum is the one by which the Board of Trade is empowered to set up a wages board for trades not scheduled in the Bill. It is pointed out that Parliament will decide, in the first instance, what trades the Bill is to apply to, and it is submitted that Parliament should in like manner decide on the inclusion of any other trades, as it is not right that a measure of such importance should be forced on any industry without the deliberate decision of Parliament.

Copper.

Messrs. Merton's circular for March 31st contains nothing abnormal. Visible supplies still stand at 51,354 tons, and although a steady falling off has been registered since the December maximum of 55,677 tons, only a decided revival in trade can bring prices badly up against such a figure.

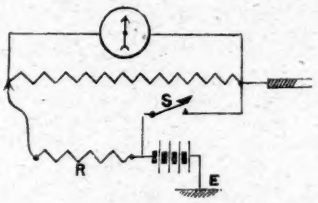
Messrs. Merton also issue an interesting sheet giving the productions of various countries for the last 18 years. The United States leads, of course, with 425,175 tons for 1908, four-sevenths of the world's production, against 128,179 tons in 1891, which was then, however, nearly one-half. Japan is next after Spain (52,585), with 43,000 tons; Australia shows 39,500 and Chile 38,315. Peru, with 15,000, is probably much under-worked, but with the practical monopoly of the States, it is only during famine prices that the opening of new mines is practicable. Commenting on these statistics, a writer in the *Times* of April 2nd does not anticipate high prices in 1908.

THE D'ARSONVAL GALVANOMETER.

By HAROLD OHLSON.

When testing short lengths of highly-insulated wire with a D'Arsonval galvanometer of about 1,000 ohms, and a universal shunt of 10,000 ohms set for a multiplying power of 1, in order to obtain the greatest sensitiveness, the movement of the coil is extremely sluggish if the short-circuit key be closed during the test for the purpose of checking the instrument zero. Also it will be noticed that on opening the key before the battery is applied, there is a small deflection, although no charge may be in the cable core under test. Both these troubles are due to the alteration of the permanent shunting of the galvanometer when the short-circuit key is opened or closed, the shunt being 10,000 ohms with key open, and practically a short circuit across the coil with key closed. The writer, in a letter published in the Electrical Review about nine years ago, outlined a simple method of eliminating both these disadvantages, but as the letter was very brief, it is thought that a fuller explanation may be of interest.

The accompanying diagram represents the usual connections for testing insulation, with shunt value 1, the only alteration being the insertion of a high resistance (100,000 ohms is convenient) at R, between battery and t avelling connection. Inserting a resistance in the galvanometer circuit, as is sometimes done, decreases the sensitiveness of the instrument considerably, but this arrangement does not affect it. With



key S open, the shunt is 10,000 ohms; with S closed, it is the resistance in parallel of 10,000 ohms and 100,000 ohms —a very small change of shunt and consequent damping. Both the disadvantages mentioned above are completely eliminated by this device, and it has also, incidentally, the virtue of damping disturbances due to a faulty battery or earth currents, and lessening the shock to the galvanometer (and perhaps some unwary person) should the free end of the cable core be accidentally earthed during a test.

This resistance is not required when capacity is being measured, as S remains open throughout the test, and it should always be removed unless the capacity is very small. For determining the constant of the galvanometer R may either be cut out or added to the resistance in circuit. It is not necessary to use it when the multiplying power of the universal shunt is greater than about 5, as then the shunting of the galvanometer changes little with the short-circuiting at S. For long sections of submarine cable R may be considerably reduced, or removed altogether. It will be noticed, however, that the battery is connected directly to the cable as long as S is closed, so that the resistance R is not in the circuit in an insulation test until about 30 seconds after the battery is applied, as the galvanometer is usually kept closed for that length of time before the deflection is observed. In fact, it will be found that the insertion of this high resistance in the manner described does not affect the electrification of the cable core in any case where, owing to the low multiplying power of shunt, the galvanometer would be improved by using it; it would only be unwise to use it when it is not necessary.

Patent Restoration.—The Comptroller-General has restored letters patent No. 27,248, dated June 23rd, 1904, granted to Société Anonyme du Temple for "Improvements in steam generators."

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

West Ham Prophets.

Mr. Seabrook's letter is not a reply, it is a revelation. It reveals the methods by which "estimates" are prepared at West Ham. Instead of the borough treasurer being a stumbling block to the operations of the electricity department, as we have been led to believe, we have here revealed a financial genius of the highest order. Happy is the position of the undertaking having the assistance of an accountant who is able to render accounts for meters read at the end of any given month, ascertain the total income to that date, make up the expenditure accounts, including interest and sinking fund, paid and accrued, "estimate" the income and expenditure for a further period, arrive at a result similar to the engineer's, present the same to the Electric Lighting and Tramways Committee, and publish the net result in the electrical Press within a fortnight. My experience of these gentlemen, to which Mr. Seabrook refers, leads me to believe that such a feat is impossible.

I do not understand the reference to a "£10,000 loss critic." Has anyone, to Mr. Seabrook's knowledge, predicted that West Ham will make a loss of £10,000 in any one year, or a total loss to that amount before commencing to earn regular profits? If so, I should say that the estimate is very moderate indeed, considering that the L.C.C. statistics for the previous financial year state the loss at £16,027, which is made up as follows:—

Interest	£15,127
Sinking fund	10,092
Transfer to reserve, &c., funds	15,019
	£40,238
Amount available for capital charges ...	£24,211
Balance decreased by	£16,027

This probably explains the reference "sinking fund charges calculated from date of expenditure," but it must still be considered as "loss."

I am told not to "worry as to costs per unit" after showing that there could only be a deficit if the figures "estimated" were realised. Mr. Seabrook should remember that the figures are his own, not mine, and therefore the "assumption and guesswork" lies with him.

There is nothing experimental in "distributing electricity for power purposes at low prices and on a large scale." The experiment lies in charging at present, prices which *may* pay in the future. The length of the experiment is commensurate with the ratepayers' patience.

There is one important point omitted in the West Ham "estimate" which might easily have been given with a fair amount of accuracy, *i.e.*, the station load factor; the average price being "slightly under 1d. per unit" the load factor must be extremely good.

By the time Mr. Seabrook is able to reply further on this subject, one month will have elapsed since the publication of 11 months' *actual* results, plus one month's *estimate*. It will then be quite a simple matter to give us the actual result of the financial year. If the result is as "estimated," I shall be the first to write congratulations; meanwhile, I will postpone my application for an extended sick leave.

Finally, I think it fair to the engineering profession to state that my connection with electricity supply is purely financial, and it is on the financial aspect of West Ham that I am a

Curious Critic.

German Engineers in English Works.

Several electrical engineering firms in this country employ large numbers of Germans, and at one works in the Midlands practically the whole management and more than half the foremen are from the Fatherland. As most of them have been in the German army and several still hold commissions, they are liable to be recalled in case of a dispute with England, and the fact that the war of the future will

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be largely a matter of engineering, in which electricity will play an important part, makes the outlook all the more serious.

That the danger is recognised by the authorities is shown by the refusal to admit a German designer from a Manchester firm into Portsmouth Dockyard, and this incident just shows how foreign the management is to have attempted it.

One way to change the existing order of things is for would-be purchasers of electrical machinery and apparatus to stop sending their inquiries to the firms who employ Germans in responsible positions.

John Bull.

Electricity in Mines.

Again, may I claim your indulgence to reply in your columns to the letters in your last issue under the above heading? "Electrician" in a very non-logical, though obviously to himself satisfactory, way concludes that the man whose principal work consists in wiring for an installation is the man *par excellence* to take charge of that installation. Similar reasoning would lead one to suppose that a ganger or platelayer was the fit and proper person to superintend and carry out the repairs to the locomotives and general rolling stock of a railway, simply because he had been instrumental in laying the means of transit for them, or that the intelligent navvy who lays the water pipes or paves the roads should adopt the functions of the civil engineer. If "Electrician" will trouble to refer again to my letter, he will see that I pointed out that the likely troublesome parts of an installation are not in the wiring, but in the generators, motors, and subsidiary apparatus which constitute, apart from the wiring, the sum total of all installations; and unless one has had efficient mechanical training, he cannot satisfactorily carry out repairs which, for their efficacy, demand such exactness as one could look for only in a properly trained mechanic. A typical wireman, for instance, would look very Quixotic with a two-mil feeler fitting up a burnt 2,000-ampere circuit-breaker. No doubt he would consider such work as a pure waste of time, and, withal, but a "poor feat of engineering skill," considering the edge of his boxwood 2-ft. rule thin enough for the purpose.

Writing of shop-trained men, this writer says they are of necessity specialists, as the shops themselves specialise. In this he is vastly mistaken, for more than one firm for whom the present writer has worked would gladly supply "Electrician" with anything in the electric line from a cigar lighter to a three or four thousand KW. machine, and would guarantee each made by the same firm. If this is specialising, I for one fail to see it. Your correspondent might suggest that a man working for such a firm would enter one department and remain there, ultimately becoming a specialist; so he might if inclined, but what if not inclined? If an efficient workman he can, with a little tact, get a move into another department, or if not, he has surely enough gumption to offer his services elsewhere, and by this means get the general experience which he requires, and, which, in due time, fits him for a position in charge of the machinery and apparatus of either light or power installations. As for "Electrician's" assertion that "it is all smooth sailing in the shops," and his conclusion that the shop-trained man's claim to be an engineer is small in consequence—Well! this extremely funny logic is far beyond my comprehension. Further, he informs us that the multifarious duties of a wireman comprise boiler work, gas producer and oil tank work, &c. Personally, I know a certain baronet whose electrician also milks his cows, in fact, I have long ago come to the conclusion that there is practically no limit to the capabilities of the general run of wiremen, for "in the course of one revolving moon they can be chemists, fiddlers, statesmen, and buffoons." "Registered and Certificated Wireman," after freely advertising himself and his qualifications, real and imaginary, goes on with a goodly show of tautological phrases, to say what he can do in the way of Brobdingnagian feats. I have my doubts whether this writer could make good his assertions, as he tacitly claims no shop training. Every school boy knows that unless a switchboard is very primitive indeed, no user would attempt to build it, but would get it completely fitted up and ready for cable connections from the manufacturer. This writer declares that he has carried out, in his capacity as wireman, such work in connection with not only direct current, but also alternating. This declaration, prodigious in itself, needs no comment. Finally, his knowledge of testing is somewhat singular, or else he does not happily express himself. Why tell us about his ability to test by fall-of-potential? Are not even the simplest tests dependent on potential drop? Perhaps he would have us believe he carries a potentiometer or Kelvin balance with his tool kit. However, his letter is away from the mark. He neither adds weight to the wireman's claim in the argument, nor detracts from the shop-trained man. In answer to his query, I may say that though not always the player, this does not detract anything from my capabilities to run strings from tail-piece to fiddle-peg, and when circumstances require it, I can play a passable first in a tolerable orchestra, either electrical or musical.

J. Brandreth.

[This correspondence is now closed.—Eds. E.R.]

House Wiring.

The objection to L.C. wiring is that the average installation carried out thus looks an unsightly job unless it is fitted up with great care. My experience in lead-covered installations is that after a few years the wiring begins to "sag" between the supporting points, and where the wiring is within reach, it is apt to get damaged, which is very easily done on account of the lead covering not being very strong on the average lead-covered wires.

I consider it is essential for the sheathing on all runs, however small, to be continuous and earthed. When taking a tapping off, the joints should be covered with a "plumbed tee" and filled with a suitable compound to preserve the joints—that is, if the whole of the installation is lead-covered. Then again, according to Rule 24, I.E.E., it is laid down distinctly that "where metallic sheathing is used it must be electrically and mechanically continuous and connected to earth"; it is most essential for the lead cover to be continuous and earthed, on account of its becoming alive or passing gas-pipes. Lead-covered wiring carelessly fixed is a great danger; it requires to be handled by a fully competent person. Rule 25, I.E.E. Rules, tells you there must be no contact between gas-pipes and conductors (or their insulating material, sheathing, or tubing); non-conducting distance pieces to be used where necessary.

According to Rule 47, I.E.E., L.C. conductors have to be supported and fixed on a strip of wood continuous in its own length.

I do not know of any rule banning L.C. altogether, and on the other hand, I don't think there are many fire offices that approve of it.

"Innocent" does not say whether it is to be used on a private plant job or off a corporation supply; if the former, he should consult the fire office; and if the latter, I am sure the officials would give him all the necessary information.

J. H. D.

Greenock.

Combined Track Circuit and Cab Signalling.

As "The Writer of the Article's" remarks in your issue of February 26th contain some totally wrong premises, and even a misquotation, I hope you will allow me space (which I will endeavour to keep as small as possible) in which to set these matters right.

"The Writer of the Article" concludes these remarks with a quotation from the report of the Block Signal and Train Control Board of the Interstate Commerce Commission dated November 20th, 1908, which quotation I now put forward as a powerful support to my claim, that it is vitally necessary in the interests of safety that the bond which the track circuit has established between the track and the signal should be extended so as to complete the cycle from the signal to the engine.

"The Writer of the Article" in his letter of December 11th appealed for further particulars if the system put forward would increase the safety of railway travelling; and it is owing to the importance of the particulars thus asked for being judged on their real merits that I crave your indulgence for a further reply.

I would for a moment carry back over the progress of this correspondence, which arose originally out of a general condemnation of my proposals as "impracticable" on the ground of an alleged intention to abolish the aid of human judgment in junction working (November 13th).

When this intention was shown by Col. Gardiner to be non-existent, "The Writer of the Article," after an extensive criticism of one sentence of my Leeds paper, in regard to which I still consider that he entirely ignores my limiting condition "as far as indicating the state of the track is concerned" (which condition expressly excludes such matters as the requirements of selection, shunting, &c.), proceeded to quote a specific junction, and asked for information as to how my system would deal with its conditions (December 11th.)

This has been supplied, and "The Writer of the Article" now falls back on to new ground, putting forward sinister hints as to "temperature curves" and "rates of wear." We are no longer in the days of "Puffing Billy" and "the Rocket!" There *are* electric railways even in England, and they are not yet worked by "wireless!" There are even signals given on the cabs of engines by means of contacts sliding over conductors on the track. No doubt the conditions presented in my case are not in every respect identical with either of the above, but there are sliding contacts in very nearly every piece of moving electrical machinery in existence, and an opinion that this may now present insuperable difficulty may be taken for what it is worth—as an opinion, and nothing more. At least it is one by no means universally held. The voltage on the insulated track conductor is not limited to any particular figure, and will, no doubt, be determined largely by experiment.

"The Writer of the Article" points out one oversight in the track circuiting, for which I am obliged to him. As he rightly admits, it can easily be rectified.

For the rest his remarks contain, no doubt unintentionally, some misstatements that it would not be fair to leave entirely unnoticed.

He states:—"The magnetic pawls would seem to be something out of the ordinary, since for a train passing from C to A without stop," their action has to be different to what it would be for a train standing between 8 and 6. This is not the case; please see Rule *f* (8). The points can be switched from "for the branch" to "for the straight," whether a train is standing on the section 6—8 or not; but if a train is anywhere (whether running or standing) between 8 and 6, they cannot be switched from "for the straight" to "for the branch"; since to do so might conceivably cause a collision. There is no difficulty, either mechanical or electrical, in providing for these conditions.

Then " . . . in describing the train selection by the pointsman Capt. Gardiner says he—the pointsman—'must pull over the points P_1 before the new train from C comes dangerously close' . . . . " My critic omits my parenthesis "(*i.e.*, before it passes the point 8)," and adds the comment "H'm!" There is no "H'm!" If the pointsman does not pull over the points before the approaching train has arrived too close for it to be still perfectly safe to do so, he will find those points locked in the safe position, that is all; and he will then have to pass the train from C to A before he can pass the train from A to D.

"The Writer of the Article" follows this up by a somewhat irrelevant tilt at the word "may" in an alleged quotation "where points may have to be moved." If he will refer to the original he will find the word "may" exists only in his own imagination.

I lay no store by "signalling by trains." I propose to signal by "the state of the track"; which, in deed and truth, is "signalling by intention," and with far fuller "knowledge of the circumstances obtaining" than any human can have without track circuit aid: but I can hardly hope that my critic will grasp this contention.

"Capt. Gardiner's new rules read like specifications to the signal company . . . . rather than regulations for the" signalman. Of course they do! The signal company is undertaking signalling once and for all, and the pointsman has, henceforth, but to select his train and set his points accordingly.

"Capt. Gardiner has no apparatus by which the pointsman can ascertain whether the signalling is in order or not." Surely fair criticism should confine itself to ascertained facts! I have devised various means for meeting what, as a professional railway man, I recognise as desiderata in railway working; but which I do not see fit at present to publish.

The question of failures of the apparatus on the engine has been dealt with both in Col. Gardiner's letter published in your issue of December 4th, and in mine of December 8th published in yours of January 15th; and I am not aware of any emergency signal that cannot, if still required at all after the advent of automatic signalling, be dealt with without the aid of a semaphore.

"Capt. Gardiner does not show" this, and he does not show that. I am aware of it. Considerations of time and space forbid. I hope I have shown enough to prove that the original conclusion, "It was all very pretty and impracticable," was not only hasty, but incorrect.

A. Gardiner,
Captain R.E.

Roorkee, India.
March 22nd, 1909.

The Same Old Game.

Being an agent for electrical machinery, &c., doing business in London, the other day I called on one of the large electric carriage companies in the hope of receiving an order from them. I was asked, if they gave me the order, would I give them (buyers) a present in cash? It is the same in taking on drivers; they have to give so much each week to one of the officials to stop in the job. I should like to know from other readers if this is the case with other firms.

Sulphuric.

Sales Engineers.

With reference to Mr. Kilburn Scott's article on "Sales Engineers," I am what he would call one of those unfortunate people without any qualifications, and yet if there are any knotty points to be solved in the design or installation of any of the apparatus made by my firm, I find that contractors are only too ready to take my opinion on the subject.

I agree with him that a man must be a commercial engineer nowadays to get the best results, but if Mr. Kilburn Scott thinks that a man is necessarily even an engineer because he has letters after his name, I think it is high time he formed a special school to bring many of these people with letters to their names up to his desired standard. Should I ever have the necessity to send in my card to Mr. Scott, I will mark it "no qualifications, but plenty of sound practical experience."

Commercial Engineer.

With regard to Mr. Scott's article, the writer is glad to see that this question is at last receiving the recognition it has so thoroughly deserved for many years.

As a sales engineer, of University, Continental and British workshop training, I can thoroughly endorse the remarks of Mr. Scott. It appears to me to be entirely the fault of the inexperience of managing directors of most of the big concerns, who are often appointed, because of family position, and very rarely because of their particular engineering abilities.

As a sales engineer, the writer held a responsible position in one of the large firms in this country, but was forced to resign because the manging director and secretary (both of them absolutely untrained men) were jealous of the personal connection, and consequent turnover. Furthermore, during the five years that he held this position, five times they reduced his commission with a view to keeping him down to a stated figure, despite the fact that he was paid on a basis

of net profits. Having resigned, despite a strong personal connection which had been proved again and again, not one firm in England could he find to take his services.

One prominent firm of enterprise (?) and foreign origin offered the magnificent salary of £2 per week and about ½ per cent. commission, finally passing him over for the sake of a young man who had been trained as a hotel clerk, because the latter was quite willing to accept the terms they offered.

Every advertisement was answered and business agents were engaged in endeavouring to find him a position, and in all cases, more or less, the same reply was given, *i.e.*, personality too strong—salary required too high.

Large concerns seem to have faith in the importance of their name only, and do not consider trained and experienced sales engineers requisite.

Perhaps the shareholders of the larger concerns will some day realise the importance of changing the management and thereby the policy. It seems that the reform cannot come by means of the buyers only.

Sales Engineer.

With reference to the letter on the above subject, I would be personally disposed to agree with the writer, but I would suggest that engineers, who are so desirous of seeing only technical men, do not act as if the result depended materially on that practice; that is to say, the destination of an order does not depend on the specialities and engineering skill, as evidenced in the design of the material, so much as upon the price. It is the harmful practice of accepting the lowest price, and the severe competition for the work, which prohibit manufacturers from considering the scientific aspect as more important than the commercial. In too many cases, I fear that the engineer is more desirous of acquiring a knowledge of the latest practice at the hands of experts than of considering the tenders strictly on their merits.

A. G. C.

Supply by Meter, or Contract?

"Unonot" says that it is no uncommon thing to find 5-ampere motor-meters accurate down to their starting current. His experience must be almost unique. Which are these meters? Will he, for the benefit of the station revenue and of the harassed meter man, give the information to the world?

If I can obtain an average accuracy within 5 or 6 per cent. down to twentieth load, I endeavour to be humbly thankful. Meter makers, as a rule, evince no great willingness to speak freely of the performances of their meters below twentieth load; therefore, "Unonot" should tell us of this treasure which follows the straight line down to zero. My experience is that, although the low-load accuracy has improved lately, many units still pass the turnstile without paying.

It is manifestly bad practice to fix a meter of larger capacity than that of the installation on which it is recording. Low-load accuracy has become of greater importance since the advent of the metallic-filament lamp, and is going to grow in importance with further lamp developments. Already we have our old friend, the Nernst, in a new guise, giving 30 C.P. on a 220-volt circuit, and consuming one-fifth of an ampere. The agreement between the capacity of the meter and its maximum load is one of the principal means of ensuring that the greatest possible number of units is recorded.

Wm. N. Goddard,
Meter Superintendent, Windsor and Slough Electric Supply Companies.

April 4th, 1909.

Regarding Mr. W. A. Toppin's letter in yours of the 9th inst., I note that he has withdrawn from the discussion, but I must state that, personally, his arguments have been far from convincing, inasmuch as they are based upon a very unfair comparison.

I entirely disagree with his further statement respecting stop-watch *v.* long-time dial tests of mercury motor meters, my results being quite contrary to his.

I only hope for the sake of our profession that when Mr. Toppin further investigates, he will first follow his own advice by obtaining the most perfect meters (of suitable capacity) available, the tests of which, if he publishes them, might render assistance to others.

Judging by his experience, I should assume that Mr. Toppin's meters were not purchased subject to the well-known specification mentioned in my last letter, as otherwise he would have obtained far better results for comparison.

In accordance with his wish, I beg to state that this is my final communication on this matter.

J. C. L. V.

April 12th, 1909.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

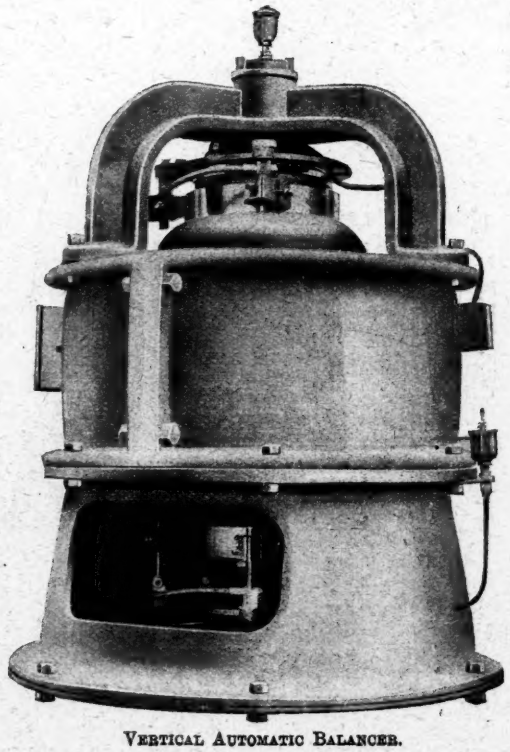
Vertical Automatic Balancer.

The Westminster Engineering Co., of Willesden Junction, have lately constructed a three-wire automatic balancer of the vertical type, of the same general design as their vertical-shaft motors.

The machine has many advantages, the chief of which are small floor space, extremely small internal losses when running light, and consequently high efficiencies at small loads. As a three-wire balancer, if the system is well arranged, should mostly run idle, it is important that the input under these conditions should be as small as possible. This particular machine, on a six-hour continuous load, is rated at 60 KW.—*i.e.*, an input or output of 30 KW. per side. The total input when running light, including excitation, is only 1,650 watts, or 2·75 per cent. of its rating as an ordinary 60-KW. generator, this low figure being largely due to the small friction losses.

The armature runs in sleeve bearings top and bottom, the load being very small on these, since they only serve as guides. In the lower bearing there is a ball thrust collar running in an oil bath, which partly takes the weight of the armature, and as the core is placed out of centre, the magnetic pull of the field magnet considerably reduces the weight on this thrust collar. As a safeguard, however, thrust washers are fitted so as to form a footstep bearing. This extra bearing would only come into service should the armature be lowered owing to trouble with the ball race, although this is very unlikely to occur.

An iron sleeve cast in one piece with an umbrella at the lower end is fitted on the upper end of the armature shaft, and this sleeve runs in a gun-metal bearing bush, the umbrella



Vertical Automatic Balancer.

running inside a deep lip ring, so that no oil can possibly run through and get on to the commutator or the armature winding, as would undoubtedly be the case if the ordinary loose splash ring were used.

The armature is of the usual double-wound slotted core type with two commutators and metal gauze brushes, with fixed sparkless position for all loads. This type of brush is used so as to give silent running, and also to obtain a better electrical balance.

The output from the heat limit point of view is 140 amperes 220 volts per armature, or approximately 280 amperes down the middle wire, but from a balancing point of view each armature is rated at 110 amperes, 220 volts, the speed being 500 R.P.M. The table given below shows the performance of the machine when running on a 440-volt system.

Volts.	Amperes down middle wire.	Volts.	Out of balance above or below normal volts.
218·7	66	221·3	·59 %
217·5	114	222·5	1·14 %
216·3	162	223·7	1·68 %
215·25	212	224·75	2·16 %
213·8	270	226·2	2·82 %
220	0	220	

Total input to machine run light = 1,650 watts.

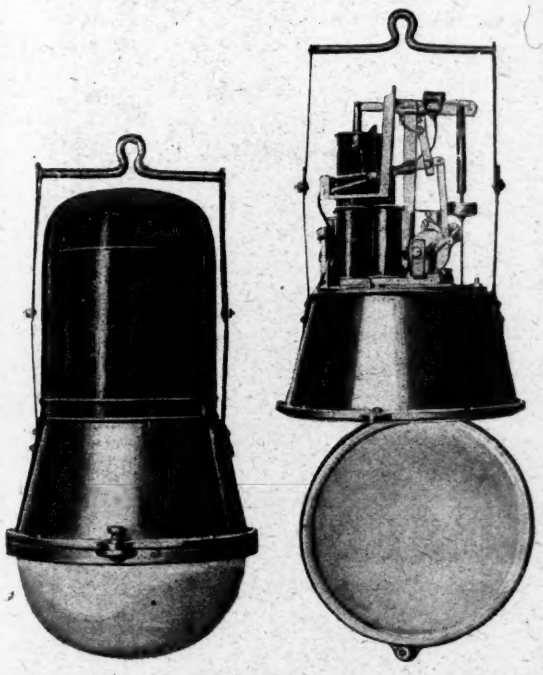
A machine of this type, being automatic, is eminently suitable for placing at the end of a long feeder to a lighting circuit. A balancer is most effective under these conditions, and it is only necessary to bring back quite a small third wire to the station for use when the machine is not running.

The particular machine here illustrated was made to the order of the City of London Electric Lighting Co., to Mr. Frank Bailey's specification, and is now running at the Royal Exchange sub-station.

Patent Disk Arc Lamp.

Finality is never reached, and apparently it is not even approached, in the development of arc lamp mechanisms. We were recently shown an arc lamp, invented by Messrs. Legge & Scott, of 82, West Nile Street, Glasgow, in which the ordinary carbon rods were replaced by disks of carbon; these were controlled by an ingenious mechanism, which fed the carbons by the simultaneous rotation of both disks, so that the periphery of each disk was burnt away uniformly. The arc was struck by separating the disks, the extent of movement being independent of the size of the disks.

We give herewith views of the model lamp open and closed; a special feature is the very short over-all dimension of the lamp, due to the use of disk carbons—a 10-ampere lamp measuring not more than 20 in. over-all. The mechanism is simple, and there



Arc Lamp with Disk Carbons.

are no sliding parts liable to be injured by fumes, the action of the mechanism being communicated to the carbons by rotational movement only, so that the mechanism can be completely separated from the arc by the baseplate. The arc always remains in one position, and as the disks are inclined to each other the light is not obstructed by them; nor are there carbon-holders or other parts below the arc. Disk carbons are stronger, less bulky, and easier to manufacture than rods, and their resistance is, of course, very low. The lamp can be used as a flame, enclosed, or open type, with suitable carbons, and, it is claimed will burn 50 per cent. longer than any ordinary lamp. A magnetic field is employed to give stability to the arc.

The external appearance of the lamp will, no doubt, be modified, as the present example is the original model; but even in this the inventors have introduced new features, in connection with the globe and case. The device represents a considerable departure from the ordinary run, and its future progress will be watched with interest.

PARLIAMENTARY.

Charging for Electricity.—In the House of Commons last week Mr. Horniman asked the President of the Board of Trade whether his attention had been called to the notice issued by the Chelsea Electricity Supply Co., by which it appears that they intend to change the method of charging for the current supplied, which will be to the detriment of a number of consumers in the district; and whether the Board would inquire into the matter and make representations to the company thereon. Mr. Tennant, in a printed reply, said "My attention has been called to the notice referred to by my hon. friend, and the Board of Trade have been in communication with the company in the matter. I understand that the notice only applies in the case of about one-fourth of the consumers in the district, and the company state that these will be prejudiced very slightly, if at all. It is, of course, open to any consumer who prefers it to require the company to supply him at a fixed price per unit. If any consumer objects to the method of charging referred to in the notice, I would suggest that he should communicate with the company, who express their willingness to confer with him as to the system which it would be to his interest to adopt."

Metropolitan Railway Bill.—Mr. J. Gibb asked in last week's Parliamentary Papers why no passenger or other traffic facility had been afforded between South Harrow, the terminus of the District Railway, and Raynes Lane, on the Metropolitan Railway, although the connection had been constructed and equipped for some years.—Mr. Tennant, in reply, stated that he was in communication with the railway authorities on the matter.

London Electric Supply Bill.—Mr. Tennant has given notice of his intention to move on the second reading of the above Bill that it be referred to a Select Committee of five members, three to be nominated by the House and two by the Committee of Selection.

Watford and Edgware Railway Bill.—The Court of Referees was engaged a considerable time on Wednesday last week in considering the objection of the promotors of the Watford and Edgware Railway to the London and North-Western Railway Co. being allowed a *locus* in opposition to their Bill, which seeks for an extension of time for the construction of the railway. It was argued on behalf of the London and North-Western Railway Co. that they served Watford, and there was no necessity for the proposed railway. The Court decided not to grant the *locus* asked for.

LEGAL.

Whittaker *v.* Rawtenstall Corporation.

At the Bacup County Court on the 6th inst., before Judge Hamilton, Mr. J. H. Pawlyn appeared for the plaintiffs, and said this was a claim, under Lord Campbell's Act, in respect of the death of J. F. Whittaker, a Rawtenstall cotton-mill operator, who was killed on the Rawtenstall tramways in a tramway accident on Christmas Eve, 1908. £675 had been paid into court by the Corporation, and 25 guineas costs. There were four dependents—the widow and three children, aged 8, 6 and 4 years.

Replying to his Honour, Mr. Pawlyn said that the deceased was killed on the spot.

His Honour elicited the fact that £33 had been swallowed up in expenses by the family since the accident, and the deceased was not insured. His Honour apportioned £214 to the widow and the remainder among the children, the money to be invested. An order was made for 25s. to be paid weekly to the widow, and £33 to be paid out of court directly.

Mr. J. L. Whitaker (Haslingden), for the respondents, acquiesced.

Pembroke Urban District Council *v.* Dublin United Tramways Co. (1896), Ltd.

On April 1st, in the Chancery Division at Dublin, before Mr. Justice Barton, an application was heard at the suit of plaintiffs for an interlocutory injunction requiring the defendants to lay down the portions of their Sandymount tramline, now being reconstructed, at the levels and in the manner prescribed and required by the plaintiffs, and to alter the levels of the surface of the tramroads so as to form the most desirable longitudinal sections of the roads to the satisfaction of the plaintiffs' engineer for an injunction restraining the defendants from forming o

reconstructing any portions of their Sandymount line otherwise than at the levels and in the manner prescribed by the plaintiffs; and for a mandatory injunction to compel the defendants to take up and relay such portions of their tramways as they have already formed or reconstructed contrary to the levels and manner prescribed by the plaintiffs as the road authority. Eventually, according to a full report appearing in the *Daily Nation* for April 2nd, a settlement was agreed to between the parties on the following terms:—The defendants undertaking that if the plaintiffs do the work of altering the levels of the macadamised portion of the road in conformity with the raised levels of the tramway, if it should be ultimately determined that the defendants were liable to do such work, the defendants will pay to the plaintiffs the costs and expenses reasonably incurred in carrying out such work; that the defendants should be at liberty without prejudice to complete the relaying of the tramways at the raised levels prescribed by the engineers of the plaintiffs, the execution of such work not to affect the defendants' contention that they are not compellable to raise the level of their tramway, and that the work hitherto and now being done is not reconstruction within the Act of 1897. "No Rule" on the motion, the costs reserved.

BUSINESS NOTES.

D.P. Batteries.—The D.P. Battery Co., Ltd., of Bakewell, report having received orders during the past week, amongst others, for 15 storage batteries of their country house type for various installation in the British Isles.

Bankruptcy Proceedings.—*Re* Arnold Roberts, 21, North Parade, Bradford, electrical engineer (under the style of "Roberts Bros.").—A summary of the statement of affairs shows gross liabilities estimated at £3,100, made up of £2,351 due to unsecured creditors, £680 contingent liabilities, and £69 for rent and wages. The liabilities expected to rank for dividend are £2,351 to unsecured creditors, and £80 of the contingent liabilities previously mentioned, which it is expected will rank against the estate for dividend. The assets are estimated to produce £902, which, after deducting creditors for distrainable rent, and preferential wages, £69, leaves a deficiency of £1,598. The causes of failure, as alleged by the bankrupt, are lack of capital and heavy business expenses. The bankrupt, who is 28 years old, is an electrical engineer. In November, 1902, he and his brother Edward commenced business in partnership under the style of "Roberts Bros.," as electrical engineers, in Lee Street, Bradford. They were joint owners at the time of two houses and shops in Rawdon of an estimated value of £450, and for capital they obtained from an uncle a loan of £300. After the first year the partnership was dissolved, and the bankrupt has since carried on the business alone, trading as "Roberts Bros." He has lost money in consequence of removing his business premises from Lee Street to North Parade, his fixed expenses having thereby been considerably added to, without any corresponding increase in the amount of business done. He has also lost £60 in connection with a dispute as to a contract respecting hoists at the Bradford Workhouse. On March 10th, in consequence of a guarantee being withdrawn from the bank, he consulted his creditors. A cash composition of 5s. in the £ was offered and accepted, but the bankrupt being unable to obtain the necessary assistance to pay this, and also receiving notice from the Bradford Corporation to determine a contract which he had with that body, he decided to file his petition in bankruptcy. The contingent liability of £680 is for the unexpired term of 8½ years of the lease of the premises in North Parade. The bankrupt estimates that only £80 of this sum will rank for dividend. The following are among the creditors:—

Adams & Co., Salford	£30
Bentley, Jas., Rawdon	348
Baxendale & Co.	17
Birch, John, & Sons, Ltd.	33
Credenda Conduit Co.	55
Edison & Swan United Electric Light Co.	151
Faraday & Sons, London	16
Frankenberg, I., & Sons, Ltd.	87
General Electric Co., Ltd.	84
Holdsworth, Fred, Shipley	37
Henley's Telegraph Works Co., Ltd.	46
Hutton, A. E.	45
Haley, J. Herbert	24
Jaeger Bros.	37
Lloyd's Bank, Ltd.	550
Muller, C. A.	148
Marsden, C., & Son	27
Metallic Seamless Tube Co.	57
Penny, T.	53
Siemens Bros. Dynamo Works Ltd.	24
Wandsworth Electrical Manufacturing Co., Ltd.	44

A meeting of creditors was held on April 8th. Messrs. J. H. Haley and R. A. Winter were appointed joint trustees with a committee of inspection.

T. C. Hodgkinson (The Electro-Neurotone) electro-medical apparatus dealer, Shepherd's Bush.—A supplemental dividend of 2½d. in the £ is payable at Bankruptcy Buildings.

T. A. Evans (T. A. Evans & Co.), electrical and mechanical engineer and contractor, 14, Heathfield Street, Swansea.—April 26th is the last day for the receipt of proofs for intended dividend, by Mr. H. Rees, Government Buildings, Frog Street, Swansea, the trustee.

Walter Wabdle, electrician, Levenshulme, Manchester.—April 21st is the last day for proofs for intended dividend to be sent to Mr. J. G. Gibson, Byron Street, Manchester.

Book Notices.—*Die Kraftfelder.* By V. Bjerknes. Brunswick: Fried. Vieweg & Sohn. Price 7 M.—Maxwell's famous equations, whilst defining the geometrical structure of the electromagnetic fields of force, do not provide any physical explanation for this structure, and since Maxwell's day continual attempts, hitherto unsuccessful, have been made to account by mechanical considerations for the electric and magnetic stresses experienced. One attempt of this sort is that contained in Prof. C. A. Bjerknes' theory, which is explained and extended in the present volume by his son, Prof. V. Bjerknes. This theory is built up from the strikingly analogous behaviour noticed between hydrodynamic and electromagnetic fields of force, the former being first studied experimentally and mathematically, and the results then applied as far as possible to the electromagnetic case. Though not yet brought to any definite conclusion, the results obtained by this method deserve careful consideration. The first seven chapters contain a detailed explanation in simple language (with the aid of scale drawings of the apparatus used) of the experimental results obtained. The close relations which exist between the stresses exerted on bodies immersed in a liquid, and subjected to varying treatment, and the stresses on bodies in electrostatic and magnetic fields are clearly brought out. This part of the book forms a simple and suggestive introduction for the non-mathematical reader to many of the intricacies of the problem of apparent "action at a distance." A chapter then follows dealing with the methods of vector analysis, especially as applicable to the problem in hand. This and the following chapters assume some knowledge of higher mathematics. Finally, the rules developed are applied to the exact solution of some of the experimental problems dealt with qualitatively in the earlier chapters. Amongst the cases investigated in this mathematical portion are those of periodic motion in a perfect fluid, the motion of solid particles in a fluid, the motions of bodies through which the fluid can freely circulate, and the field of force in a fluid of which the particles have gyrostatic characteristics.

Elektrotechnische Messungen und Messinstrumente. By Gustav Wernicke. Brunswick: Fried. Vieweg & Sohn. Price 5 M.—This compact and well arranged account of electrical measurements and measuring instruments forms Vol. 13 of the well-known series "Elektrotechnik in Einzel Darstellungen." It does not contain very much in the way of new information, but it deals concisely and in a thoroughly practical manner with the more usual measurements. Typical instruments are described and well illustrated, and the possible sensitiveness attainable and the sources of error are in each case dealt with. Chapter I discusses the electrical units, standard cells, standard resistances, condensers, &c. Chapter II deals with direct and alternating current and voltage measurements, and Chapter III with power measurements, including polyphase circuits and the determination of power factors. Chapter IV contains a full description of resistance measurements, including insulation measurements on live and dead mains, and Chapters V and VI deal with inductance, capacity, magnetic flux and iron loss measurement. The omission of all particulars of cost, especially the relative cost of the various types of instruments, is a fault that should be remedied in the next edition.

Le Reglage des Groupes Electrogènes. By J. L. Routin. Reprint from *La Lumière Electrique.*—In this series of articles the author gives a most detailed and exhaustive discussion of the whole subject of regulation, this being probably the first occasion on which the various methods available have been analytically studied in this manner; finally, a description of the admirable system evolved by M. Routin, of which we gave particulars recently, is added. The brochure is well worth serious attention.

Messrs. S. Rentell & Co., Ltd., 36, Maiden Lane, inform us that they act as the trade publishers for Mr. Few's book on "Questions and Solutions in Telegraphy and Telephony," reviewed in our last issue, and inquiries should be sent direct to them.

"Spon's Workshop Receipts." Vol. I. London: E. and F. N. Spon, Ltd. 1909. Price 3s. net.

"Berechnung und Konstruktion Elektrischer Schaltapparate.' By R. Edler. Hanover: Dr. M. Jänecke. 1909. Price M. 12.

Tantalum Lamps.—Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E., announce that they are now able to supply tantalum lamps for 200-250 volts in 32 and 50 c.p. In general appearance these lamps closely resemble tantalum lamps of lower voltage, except that they contain two filaments wound upon two sets of supporting arms instead of one only. We have received a circular containing particulars of the new lamps, together with details concerning tantalum candle lamps. The latter are supplied with plain candle-shaped bulbs for use in candle fittings, with small bayonet or small Edison screw caps for 24-40 volts, 5 or 10 c.p. This circular, which is of the same size as their catalogue 4A, can be obtained on application.

Catalogues.—Messrs. F. Harding Churton & Co., Atlas Works, Leeds.—We have received price lists recently issued by this firm descriptive of the induction type motors made by them for single, two, and three-phase currents. Polyphase motors are dealt with in list No. 26, and full particulars of H.P. and speed on circuits of various periodicities, efficiencies, power-factor, &c., are given for a series of sizes ranging from ¾ to 300 H.P. Motors with the short-circuited or squirrel cage type rotors, as well as with wound rotors and slip-rings, are described and illustrated, and the prices of these and of appropriate starters and other accessories are

given. A special list is included of motors designed and rated for operating cranes, or for other such intermittent duty. Single-phase motors are similarly dealt with in list No. 27. These motors are made in standard sizes from ¾ to 110 H.P. In general construction the motors are of the makers' standard pattern, but improvements have recently been introduced in the design giving increased efficiencies. We learn that Messrs. Churton's works are fully employed, their contracts on hand including A.C. motors for H.M. Government; two-phase motors for the electrification of the Leeds Forge Co.'s Works; A.C. motor-pumps for the Croydon R.D.C., to deliver 51,000 gallons per hour; two-phase motors for operating the new textile department of the Leeds University; three-phase variable speed motors for the *Chatham Observer*, and many others.

Mr. C. Schniewindt, Neuenrade, Westfalèn.—Pamphlet in French and English, describing his new N.E.G. lightning arresters. Copies of the list can be obtained on application.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, E.C.—Publication No. 148, consisting of 44 pages of illustrated matter, excellently arranged and produced, describing, and setting out prices of, their various railway and tramway telephones and telephone accessories. A list of corporations, &c., using the Sterling traction telephones occupies a page. In some cases diagrams of connections are given.

The Weston Electrical Instrument Co., Aubrey House, Ely Place, Holborn, E.C.—Handy pocket catalogue of about 120 pages, giving full particulars and neat pictures of many of their electric measuring instruments. The book forms a reduced photographic reproduction of their large catalogue No. 15, and the facsimile scales shown are proportionately reduced.

The Switchgear Co., Ltd., Cornwall Buildings, Newall Street, Birmingham.—A number of illustrated lists in binding cover, showing and giving prices, &c., of their various switchgear, fuses, circuit-breakers, motors-starters, &c.

Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—List No. 1,013, of dynamos and motors of moderate sizes. The range of the machines has been considerably extended, and includes both double-voltage machines and boosters for cell-charging purposes, also motors wound for 150 and 300-volt circuits. Prices are considerably reduced. List No. 1,407, showing and pricing the "Kandem" easy trimming arc lamp-coupler.

The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Aston, Birmingham.—Leaflet L66 illustrating and stating prices of their high-voltage double-pole turn switches.

Messrs. E. Reader & Sons, Ltd., 5, New London Street, E.C.—Several illustrated lists giving descriptions, prices, dimensional and other particulars of the following:—No. 13A. Single-cylinder enclosed vertical steam engines with forced lubrication; No. 13B. Compound two-crank enclosed vertical steam engines with forced lubrication; No. 15. Single-cylinder open type vertical steam engines; No. 16. Single-cylinder enclosed type vertical engines with "splash" lubrication.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.—Leaflet concerning his patent motor-driven rotary scraper for cleaning colliery tubs.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—Priced leaflet of new high-voltage tantalum lamps.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, E.C.—Full catalogue of about 120 pages wherein are given illustrated particulars and prices of a great variety of their electric bell and telephone manufactures. Copies of the catalogue will be forwarded to any representative of the trade on receipt of trade card. Prices have been revised and additional lines are included. Many diagrams of connections, and a numerical index and code, are given.

The General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—Several new publications. First we should mention a handy-sized volume "The Contractors' Handbook," which has been neatly and strongly bound to stand pocket wear and tear, and which is designed to provide the electrician and contractor with a ready means of turning up standard prices in a number of the lines that are of leading interest in telephone, bell and electric lighting and Geekoduct conduit work. List No. E, 1,303, describes the "Angold" magazine flame arc lamps for continuous-current circuits, and E 1,302 deals with "Flamgold" gravity feed arc lamps.

General and Domestic Electric Co., 19, Robson Street, Liverpool.—Leaflet relating to cheap electric kettles and irons.

Messrs. Classen & Co., Barbarossastrasse, 16, Berlin W 30.—New flyleaf relating to their Fludor solder, giving prices of the various forms in which the flux and solder are made up.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—Revised illustrated and descriptive price list (12 pages) of galvanic batteries, including Silvertown Leclanché cells, medical, testing, Poggendorf bichromaté, Daniell and Silvertown improved low-resistance batteries.

Messrs. Voss & Co., 14 and 15, New Yard, Great Queen Street, W.C.—16-page pamphlet giving illustrations and prices of their "Voss" electric flashers.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.—Well arranged catalogue, in which is fully described and illustrated the "O.S." wiring system with "Metacase" conductors and accessories, of which particulars recently appeared in our pages. New circular giving prices and details of their "Indispenso" porcelain connector, and enamelled steel outside lanterns.

Trade Announcements. — Messrs. J. and H. Grevener, of Eldon Street House, London, E.C., inform us that they have now taken over the sole agency in the United Kingdom and the English colonies for the sale of the well-known manufactures of the Land and Sea Cable Works, Ltd. Very large stocks of wires and cables of every description are held in London, and also in the chief provincial towns. Messrs. Grevener have recently appointed the following firms to represent them for the sale of wires and cables of every description:—Davies Bros., Adelaide Street, Swansea, in Wales and the West of England; Hamilton Bros., 19, Waterloo Street, Glasgow, in Scotland.

Messrs. Jeffery Bros. inform us that they are commencing business at 56, Plashet Road, Upton Park, as flux and solder manufacturers. In our issue of March 12th we referred to the flux devised by Mr. W. S. Jeffery, which enables aluminium to be soldered to aluminium, copper, brass, iron, &c., with ordinary tin-lead solder, and we understand that this will be the leading feature of the new firm's products.

The Switchgear Co., Ltd., of Birmingham, will, on April 19th, open an office at Manchester (Wilfred Street, off Sherbourne Street, Salford), which will in future be their headquarters, the Birmingham office being retained for local purposes.

Messrs. R. Easton & Son, lift and crane makers, have removed to their new premises in 28 and 30, Southwark Bridge Road, S.E., which they have had rebuilt to cope with the extension in their business; quicker deliveries will now be possible. The firm were for 40 years in continuous occupation of their old premises in Sumner Street.

Dissolutions and Liquidations.—J. R. Norris & Co., electrical engineers, Manchester Street, Oldham.—Messrs. J. Henderson, jun., and J. R. Norris have dissolved partnership. Mr. Norris will attend to debts and continue the business under the old style.

Rossendale Valley Tramways Co., Ltd.—This company is being wound up voluntarily with Messrs A. R. Abbott and J. V. Kitchener as liquidators.

J. Defries & Sons, Ltd.—A meeting of creditors will be held at 147, Hounsditch, E.C., on April 14th. Claims to Mr. A. F. Whinney, 32, Old Jewry, E.C., the liquidator.

Hampson Boiler Patents, Ltd.—A meeting is to be held at 133, Fenchurch Street, E.C., on May 14th, to hear an account of the winding up.

Sherard Cowper-Coles & Co., Ltd.—This company is winding up voluntarily, with Mr. A. E. Tugwood, 82, Victoria Street, S.W., as liquidator. A meeting of creditors is to be held on April 21st.

Thomas R. Martin & Co., Ltd., Pilgrim House, Pilgrim Street, Newcastle-on-Tyne.—A meeting of creditors was held at the offices of the liquidator, Mr. Charles Gray, 37, Albert Road, Middlesbrough, on Friday, February 26th. A statement of affairs was submitted, and it was resolved to continue the voluntary liquidation, with Mr. Gray as sole liquidator, the Gilbert Arc Lamp Co., of Chingford, acting with him as a committee of inspection. The liabilities were stated at £808, and there was a deficiency, subject to realisation upon unsecured creditors' claims, of £435.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. J. A. Bell, the Corporation electrical engineer, has prepared a lengthy report showing the methods of charges and rates for electricity supply, at present in use by the principal Corporation undertakings; the prices charged for Corporation tramways as supplied from municipal combined stations, together with the lowest prices charged for ordinary power supply in the same place, &c., and giving details of the Aberdeen undertakings. Mr. Bell points out that under the present system the long-hour lighting consumer obtains his supply at from 2d. to 3d. per unit, which compares favourably with undertakings similarly situated. The increase of the output of the station, with improved load factor, was the point the Corporation should continue to devote most attention to. When dealing with the charges the Corporation should consider the use of slot meters for certain classes of lighting consumers, and as regards power rates, rearrange them so as to include the large power users, and the daylight undertakings, such as the granite industry. A low rate for heating and cooking would also be of benefit to the undertaking, while public lighting should be put on a fixed rate per lamp.

Bath.—The T.C. has had under consideration a recommendation to apply for sanction to a further loan of £11,699 for electrical purposes, to cover expenditure which has been incurred during the period of negotiations with Mr. Schenk in regard to taking over the undertaking. Further correspondence has taken place with Mr. Schenk, the question of a new agreement having been considered, but apparently the Council has decided not to reopen the question of the sale of the undertaking.

Bethesda.—The U.D.C. has under consideration an electric lighting scheme prepared by Mr. Price White, an electrical engineer, of Bangor.

Bray.—At the meeting of U.D.C. last week, a discussion arose on consideration of the electrical engineer's recommendation that an English expert be engaged to overhaul an engine at the electric lighting station, and also a recommendation that a loan of £2,600 be applied for to carry out the proposed extension and improvements in the electric lighting system. There was considerable opposition to the proposed employment of an Englishman, but the recommendation was carried by a majority.

Brighton.—The B. of T. has informed the T.C. of its approval of the following charges for electricity supplied to Rottingdean:—Lighting, without restriction to time, 4½d. per unit. Power, heating and cooking, without restriction to time, 2d. per unit up to 250 units per half-year; over 250 and up to 500, 1¾d.; beyond, 1½d.

Burnley.—At the last T.C. meeting the question was considered of fixing a minimum annual sum for a supply of energy to premises having an independent supply, so as to give the Corporation a reasonable return and to cover standing charges. The electrical engineer submitted information from other towns, and the lowest price—£3 10s. per KW.—was adopted. There are in the town, it was explained, six firms which had a stand-by, and the money received from them last year was £209. At the price of £3 10s. per KW. they would have called upon them to pay £633.

Buxton.—A L.G.B. inquiry was held on April 7th into the application of the U.D.C. for a loan of £724 for improvements at the electricity works. There was no opposition.

Canada.—The Ontario Hydro-Electric Commission has awarded contracts for the electrical equipment of 12 stations on the transmission lines between Niagara Falls and Toronto, and Niagara Falls and St. Thomas. The apparatus includes a protective system for each station. The installation will provide for the supply of power to not less than 28 towns and cities of Ontario.

Chichester.—The electricity works, which have been designed by Mr. Horace Boot, are nearing completion, and it is hoped that the supply will be given in a few weeks' time. This is one of the first electricity works relying entirely on Diesel oil engines for its prime movers, and these have been supplied by Messrs. Mirrlees, Bickerton & Day. The contractors for the whole of the works are Messrs. Johnson & Phillips, and Mr. Boot has had as his clerk of works, Mr. R. V. Weare.

Colwyn Bay.—The U.D.C. has decided to install additional plant to meet the extra demand for energy for the tramways.

Dudley.—The Council has adopted the proposed extensions to the electricity station, including the installation of a battery, &c.

Dundee.—The T.C. is to call in an arbitrator to settle differences which may arise between Messrs. Robert McAlpine, the contractors for the new generating station, and the burgh engineer. It was stated that the Council had a claim against the contractors for delay. One of the causes for the delay in the completion of the station is said by the burgh architect to be the change by the Council from a light design of superstructure to a heavier and more permanent form of structure. Mr. Richardson, the Corporation electrical engineer, reports that his department is not responsible for any of the delay. Most of the machinery has been ready and waiting for delivery for some time. He is quite confident that the works could have been ready for last winter's load had he been allowed to carry out his original scheme.

Edinburgh.—The Corporation Electric Lighting Committee has expressed willingness to supply power on the most reasonable terms to the company which is proposing to construct the new tramway to Colinton, but in view of the report on railless electric traction and the possibility of the Corporation taking control of the suburban traffic, it has been agreed to defer consideration of the scheme. The War Office, in connection with the Redford Barracks, is behind the company.

Epsom.—The U.D.C. has decided to approach local tradesmen to see if they are willing to carry out a system of free wiring, the Council, so far as it legally can do this, collecting all amounts due on the deferred payment system.

Falkirk.—The policy of the T.C., which possesses electricity works of its own, in taking a supply for power purposes from the Scottish Central Power Co., instead of extending its own plant, is still being criticised. It is pointed out by those who favour the step that when the details of the agreement between the Council and the company are made public, it will be found that the Corporation retains its full authority as the medium of supply. On the other hand, it is contended that since the Corporation works were opened not a single farthing of the rates has been spent on their up-keep, and that the cost of the extension would have fallen on the users of electricity and not on the general ratepayer. It is still held that the Council is not fulfilling its obligations under the provisional order.

Gillingham (Kent).—Subject to the War Department entering into a three years' contract, the T.C. has decided to supply electricity to the Royal Engineers' Mess and Officers' quarters at Brompton barracks at 2·75d. per unit.

Glasgow.—After a conference, the T.C.'s Joint Sub-Committee of the Tramways and the Electrical Committees approved a report by Mr. Dalrymple, manager of the tramways, and Mr. Lackie, of the electricity department, in which these gentlemen say:—"We are convinced that no sufficiently substantial benefit could accrue by disturbing the present working arrangements between the Tramways and Electricity Committees, unless and until some change of circumstances should arise in the position of the two departments, which might require the whole question of the production and distribution of electrical energy to be considered anew. We are at present looking into the demand at different hours of the day and night, and on different days of the week, on the generating stations of both departments, and if further economy can be made as the result of this inquiry, we will arrange a regular interchange of energy, so as to ensure that the minimum of plant is run to meet the aggregate demand of the two departments.

Haslingden.—At the meeting of the Board of Guardians on the 7th inst., the clerk stated that application had been made to the L.G.B. for sanction to the scheme for the erection of plant at the Workhouse for the generation of electricity. An inquiry had been held in December, but nothing further was heard till a month ago, when he was instructed to ask the result of the inquiry. The L.G.B. replied that before it was prepared to deal with the application, it thought the Guardians should consider the further offer which had been made by the Rawtenstall Corporation since Mr. Hooper held the inquiry. A committee was appointed to inverview the Rawtenstall Corporation to discuss the final offer.

Hereford.—It is proposed to hold an electrical exhibition in the local drill hall from May 10th to 15th.

Herne Bay.—The B. of T. has informed the U.D.C. that its application for a prov. order for E.L. has been granted.

Jamaica.—The town of Montego Bay is to have electric lighting, a new company, entitled the Montego Bay Electric Light and Power Co., having been formed, with a capital of £5,500, in shares of £1 each, half of which has already been subscribed, the townspeople having taken up the scheme eagerly, and promised every support. Montego Bay is now a well-known winter resort for visitors from the United States and Canada. The address of the promotor of the company, Mr. S. S. Wortley, jun., is 72, Harbour Street, Kingston, Jamaica.—*Jamaica Daily Telegraph.*

Leyton.—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £1,650 for the extension of the electric power station. There was no opposition.

London.—Shoreditch.—The Borough Councils of Hackney, Shoreditch and Stepney have agreed to hold an East London electrical exhibition to be open from October 18th to October 30th next. The management is to be left in the hands of Mr. Russell, of Shoreditch, who will have the assistance of the electrical engineers of Hackney and Stepney as far as possible. The boroughs are to share equally in the expenses, and tickets of admission are to be purchased by the local authorities at their face value.

Long Eaton.—At a meeting of the U.D.C. on Monday, the engineer reported that the number of units generated during the month was 104,521, as against 68,184 in the corresponding period of last year. The engineer also reported that for the year to March 25th the total number of units generated was 1,012,443.

Loughborough.—The T.C. has decided to reduce the price of energy for combined lighting and power purposes for workshops and factories, for night shifts between the hours of 9 p.m. and 8 a.m., to ¾d. per unit.

Maidenhead.—The T.C. has applied to the L.G.B. for sanction to a loan of £3,500 for the extension of the power station and plant.

Middlesbrough.—At a meeting of the E.L. Committee on the 7th inst., the electrical engineer reported that he had received an inquiry from the North-Eastern Railway Co., asking upon what terms the Committee was prepared to supply the docks with electricity in the event of the company removing its own plant. The chairman of the Committee and the electrical engineer were empowed to negotiate with the company and report.

Newcastle-on-Tyne.—The Board of Guardians has signed an agreement with the Newcastle and District Electric Light Co. for a supply of electricity at 2¼d. per unit for lighting, and 1½d. for power.

Newcastle-under-Lyme.—The T.C. has received sanction to a loan of £700 for service and mains extensions.

Newport (Mon.).—The T.C. has received from the L.G.B. sanction to a loan of £2,578 for new plant at the generating station.

Radcliffe.—The U.D.C. electrical undertaking has made a profit of £1,100 during the year, as compared with £600 last year. For the present the profits are being carried to a special depreciation account.

Rotherham.—A scale in respect of the supply of electricity for power purposes has been adopted by the Corporation. When the consumption exceeds 5,000 units per annum the price is to be 1d. per unit, discounts to be allowed of 5 per cent. on 10,000 units consumption, and proportionately up to 750,000 units consumption, on which 40 per cent. discount is to be allowed.

St. Anne's-on-Sea.—At a recent Council meeting, a proposal to carry £700 from the electrical profits to the relief of the rates was opposed by Councillor Cooper, who pointed out that out of 1,937 householders only 655 were electricity consumers, and that it was unfair to make the latter subsidise the ratepayers as a whole, when prices like 7d. and 2d. per unit (maximum demand) and 5½d. per unit (flat) were being charged. The proposal was eventually agreed to.

Salford.—Arrangements are to be entered into for the supply of energy on reduced terms to the Bradford Dyers' Association, Ltd., for their works at Liverpool Street and in Meadow Road, and to the Broughton Copper Co., Ltd. (minimum annual consumption, 350,000 units). The L.G.B. is to be asked to sanction a loan of £2,200 for the sinking of a bore hole at the electricity works, and the erection of pumping plant, &c., required in connection with the supply of water for condensing purposes.

Sheffield.—The T.C. has adopted a petition in favour of the Electric Lighting (Admendment) Bill, 1909, the idea being to obtain powers to supply outside the area in cases where thought desirable. The Corporation has received an application for supply in Tinsley, and application is to be made to the B. of T. for a prov. order authorising such supply within so much of the area as may be mutually agreed upon by the T.C. and Yorkshire Electric Power Co. Application is also to be made to the L.G.B. for sanction to borrow £1,300 to defray the cost of the work.

South Africa.—Uitenhage.—The T.C. has finally resolved to enter into a contract with the General Electric Co., London, to light Uitenhage by electricity at a cost of £14,300, the company to get a concession for ten years. The plant may be taken over at any time after five years by the Council at a valuation.

Wallasey.—The U.D.C. has agreed to reduce the price for electrical energy supplied for heating and cooking purposes from 2d. to 1½d. per unit.

Wigan.—The Electricity Committee has passed plans for the extension of the generating station. Tenders are to be invited for the building work and for plant required. A sub-committee and the electrical engineer are to visit works where turbo-engines are being made or in operation, and also places where coal conveying plants are in use.

Woking.—After conducting various tests as to the efficiency and economy of gas and electric lighting respectively, the school managers of Woking have decided to wire and fit with electric light throughout several of the schools they have the management of. The electric lighting test was carried out at the Monument Hill school, where 12 Osram lamps were running for 12 hours at a cost of 3s. 9d. The cost of maintenance in this case was deemed so low as to be scarcely worth providing for.

Worthing.—The estimates of the electric lighting revenue accounts for the next six months show a probable deficit on September 30th next of about £440, but the Committee anticipates that by the end of March next year that deficit will be turned into a credit balance of £340. Having regard to the fact that some £600 a year less is now being paid from the rates for public lighting, and that £500 a year is being placed towards the depreciation fund, the members of the T.C. consider this fairly satisfactory, and an indication that the undertaking has at last turned the corner.

Wrexham.—With regard to the application of the T.C. for a loan of £6,850 for E.L. purposes, the L.G.B. has sanctioned £4,385 for excess expenditure, extension of buildings, mains, house services, and motors.

TRAMWAY and RAILWAY NOTES.

Bacup.—At the meeting of the T.C. on the 7th inst., the town clerk reported that the B. of T. had sanctioned the borrowing of the following sums for the electrification and reconstruction of the tramways:—£17,600 for permanent way and buildings, repayable in 30 years; £170 for expenses incidental to the purchase of the Rossendale Valley Steam Tramways undertaking, repayable in 25 years; £8,000 for electrical equipment, repayable in 20 years. It was resolved that the Council considers it desirable that the question of continuing the proposed tramways from Rochdale to Shawforth, to the centre of Bacup, should receive consideration. Councillor Greenhalgh expressed his pleasure that the Council was taking the present step, as he believed it would be a good thing to have the tramways running right through from Rochdale to Bacup, and not to Shawforth only. The Deputy-Mayor said he understood the proposal of the Whitworth Council was to bring the cars to the Bacup boundary, and what Bacup would have to consider, would be the bringing of the cars to the centre of the town.

Belfast.—The general manager of the tramways reporting on the result of the last year's working, stated that the revenue amounted to £195 043, and working expenditure to £108,881; after meeting charges against net revenue account, including the annual payment of £8,962 to the general purposes fund, a surplus of £36,791 remained, which is carried to the appropriation account. The appropriation account is allocated according to Act of Parliament, and £13,000 is to be paid towards depreciation, the balance going to sinking fund account. The debit balance against the net revenue account in the previous year has also been reduced to £1,265, and on the whole the returns show an increase in profit of some £10,300.

Bolton.—Last year the tramways carried 25 million passengers, the receipts amounted to £119,437, and the mileage run was 2,556,511.

Bradford.—Preliminary reports on the working of the Corporation tramway undertaking show an increase in receipts during the past year of £1,145; this, however, is neutralised by the decreased revenue from advertising, and it is expected that the revenue will, on the whole, be some £400 less than in the previous year; this on a total of some £240,000. The receipts from the carriage of parcels amounted to £7,126.

The Tramways Committee has recently considered the question of insurance against Third Party Risk, and has decided not to vary its present procedure in dealing with and settling claims itself.

The general manager is to report on the question of ½d. fares, and has recently reported on the advisability of erecting a central car depôt, to accommodate the bulk of the cars and replace the corrugated iron sheds in various parts, the leases of which are about to expire.

Chatham.—As the result of an appeal, the assessment of the tramway of the Chatham and District Light Railways Co. from Rochester boundary to Borstal (2¼ miles), has been reduced from £1,200 gross and £440 net, to £980 gross and £180 net.

Continental Notes.—Germany.—It is announced that the special plans for the projected conversion to electric traction of the Berlin City, circle and suburban railways, have now been worked out by the State Railway Department, which was entrusted with the duty of solving the problem on behalf of the superior Berlin Railway Administration. The plans, which will shortly be placed before the Ministry of Railways, provide for the transformation of the whole of the lines concerned, and the erection in the east and west of Berlin of two large power stations for supplying the railways. But according to recent statements of the Railway Minister, the realisation of the whole of the scheme is still undecided, although it is assumed that a beginning will be made by the conversion of a suburban line which is complete in itself, probably the Wannsee Railway. Apart from the three leading electrical groups, it is expected that the Bergmann Co., which has arranged to work the Westinghouse system, will participate in any competition which may be opened for the conversion of lines.

Belgium.—Work is well in hand on the conversion of the tramway between Antwerp and Brasschaet to electric traction, and it is expected that the line will be opened for traffic at the end of next month.

Conway.—The Llandudno Electric Railway Co. having written to the T.C. on the matter of extending the tramway from West Llandudno to Deganwy, the Council is to reply, asking for a definite statement as to the company's plans.

Croydon.—In connection with the L.C.C. tramway extension from Streatham to Norbury, arrangements have been made for a system of through bookings between London and Purley on the basis that the amounts to be apportioned between the authorities be in accordance with the fares for the distances traversed in the area of each authority. At the last meeting of the Council, Alderman Trumbell mentioned that under the new arrangements, people would be able to travel from West Croydon to Victoria for 4½d., and the journey would probably occupy about 50 minutes.

Devonport.—The T.C. seems determined to "get its own back" from the Devonport and District Tramway Co. for ceasing to run cars over the leased lines in the borough. The latest phase in the dispute is that the Council has decided to strictly enforce the by-law prohibiting overcrowding on the cars, and the familiar "strap-hanger" is thus abolished. The company has to either lose a large number of passengers during the busiest time of the day or run extra cars to cope with the traffic. There have been two conferences between the Council's representatives and the directors of the company at the offices of the B. of T., but as the price offered by the Council is considerably below that which the company will accept, no result has yet been arrived at.

Dunfermline.—The promoters of the tramway scheme are negotiating for a site for car-sheds at Cowdenbeath. At Monday night's Council meeting the Provost stated that the laying of the tramways would not be long delayed, and it was hoped to see Dunfermline linked up with the outlying districts before the end of the year.

Glasgow.—The Tramways Committee has agreed to delay consideration of proposed extensions at Coatbridge, Kirkintilloch, Springburn Park, and Provonmill. The questions of advertising in the cars and providing letter boxes on same are under consideration.

Isle of Man.—On Saturday night last, at 11 o'clock, an accident occurred on the Manx Electric Railway, between Douglas and Laxey. Great numbers of excursionists were returning from Laxey, and cars were running at frequent intervals. A number of passengers on one of the cars were attempting to alight while the car was in motion, and the driver pulled up. In the confusion a lamp was broken in the trailer, throwing the car into darkness, and it was run into by the following car. About a dozen passengers sustained injuries, and the glass and woodwork in both cars were splintered. Fortunately no serious results are anticipated.

Kirkcaldy.—Proposals are on foot to connect the various towns in the neighbourhood by tramways. One of the schemes is to construct a tramway between Kirkcaldy and Inverkeithing, and

the other to extend the present Corporation route to Kinghorn. At the Monday meeting of the Council a letter was submitted from Messrs. P. Gardiner, Gillespie & Gillespie, S.S.C., Edinburgh, stating that clients of theirs were prepared to construct a tramway from Kirkcaldy to Inverkeithing. They offered to arrange a meeting with the Council to discuss the scheme. It was agreed that the Tramway Committee should meet the promoters and report to the Council.

At the same meeting it was moved that Parliamentary powers be asked for the extension of the Corporation tramways from West Bridge *vid* Bridgeton and Kinghorn Road, on to the railway bridge, which is close to the Seafield summer resort, and near Kinghorn. The Tramway Committee is to consider the matter.

Liverpool.—With the object of lessening the risks of accident, Mr. C. W. Mallins, the tramways manager, has brought out an ingenious device. It is claimed that the invention ensures the tread of the footboard being so adjusted as to yield slightly when a passenger steps on to it, and by yielding it operates by means of a connecting switch either a visible or an audible indicator at the front of the car. For experimental purposes a car has been fitted with both kinds of signals, consisting in one case of a bell, and in the other of a red light located near the lever controlling the current. When the motorman gets the signal, he is aware that the footboard is not clear, and it is then his duty to pull up or to use such care as will prevent the occurrence of an accident. So impressed is the Electricity and Tramways Committee with the utility of the idea that it has been adopted for use on the Liverpool cars.

The future of first-class cars is not rosy, but the Committee is not going to let the experiment come to an end without a struggle. Some little time ago there was a revision of fares, in order to tempt the patronage which did not come, and fearful of the oncoming failure of the experiment, the Committee at a recent meeting proposed a further revision, by allowing outside passengers to travel at the fares charged on ordinary cars, while the inside fares would continue as at present on the first-class cars, except that the through fare from Pierhead to Garston would be brought down to 4d.

Liverpool-Southport.—The cars on the electrified Liverpool-Southport lines of the Lancashire and Yorkshire Railway have end doors. Arising out of a collision between two electric trains and a subsequent fire on January 21st last, the railway company recently made a test as to how long it takes for the passengers to alight. No one, except those making the test, knew of the trial. It was found on an average that with a door at each end of the car 16 passengers will leave in 10 seconds. The most was 63 seconds for 86 passengers to leave a trailer car which had a seating capacity for 80 passengers. Other cases were 93 passengers in 53 seconds, and 76 in 39 seconds.

London.—Some two to three hundred employés of the London United Tramways came out on strike on Sunday last, but this did not materially affect the holiday services of the company. There appears to be some prospect of trouble between the L.C.C. and its tramway employés, a meeting having been held in North London by some 600 employés, representing 2,000 of the Council's staff, at which a strike of all the employés was freely suggested as a way of obtaining certain demands in regard to Sunday employment.

L.C.C.—In our last issue we referred to the recommendation of the Highways Committee in regard to the future of the Aldgate to Bow tramways. This recommendation came before the Council meeting on April 8th, and was eventually passed, Mr. Shirley Benn, Sir John Benn and Mr. Whitaker Thompson among others having spoken on the matter. Mr. Shirley Benn said that in 1906 their officers reported that the "G.B." system was the best surface-contact system, but they could not vouch for its success in London until an experiment was made. The system had been tried experimentally, but the Committee's officers could not approve it. The system might be an extremely good one, likely to be a success, but he did not think it suitable for London traffic. Mr. Whitaker Thompson said he could only give the recommendation lukewarm support; he still believed the surface contact system was the system of the future. Life, he said, was a burden to members of the Committee when the matter was on the agenda paper. It had been done to death by slanderous tongues, and many members of the Committee felt that they had not received loyal support from a large section of the Council. The decision of the Council is to reconstruct the line partly on the conduit and partly on the overhead trolley system—the use of the latter system depending on the consent of the Stepney B.C. The latter Council has considered the matter and decided to defer giving any approval until the L.C.C. proposals come before it in a definite and tangible form.

Musselburgh.—The East Lothian C.C. has had under consideration certain proposed tramway extensions from Levenhall to Port Seaton, which it was suggested should not be carried out until certain road widenings had been made.

Rawtenstall.—Subject to the approval of the T.C., arrangements have been made with the Accrington Corporation for the running of through electric cars from Rawtenstall to Accrington. All money drawn on the Rawtenstall section will go into the Rawtenstall exchequer, and outside the borough of Rawtenstall the receipts will be taken by Accrington, each Corporation supplying its own electricity. With respect to the reconstruction of the Rawtenstall tramways, it was anticipated that within a fortnight the whole of the tramways within the borough would be finished.

Reading.—The returns for the Corporation Tramways system for the year up to March 18th last show receipts amounting to £30,437, which compares with £30,519 in the corresponding period of the previous year.

U.S.A.—The cities of New York and Chicago, 970 miles apart, are now coupled up by electric trolley lines, some 200 separate lines forming the network.

York.—At the meeting of the T.C. last week the report of the Tramway Committee, which was adopted, stated that tenders from 18 firms for the electrical reconstruction of the tramways had been opened, and the overhead system could be installed for £87,000. The existing horse tramways had cost £11,000, and with about £500 for incidentals, this would bring the total cost of the undertaking to £109,323. The Council considered the various tenders at a special meeting, and a resolution to decide on the overhead system was only lost by the casting vote of the Mayor.

TELEGRAPH and TELEPHONE NOTES.

China.—The Japanese Government Telegraph Department announces that its telegraph offices in Manchuria, viz., Shinminfu, Taikozan and Taitoko are closed. There are, however, Chinese offices in these localities. The Chinese Government has opened new telegraph offices at Anshunfu, Shihlung and Gwongchow in the provinces of Kweichow, Kwangse and Honan.

Jamaica.—The Government, in response to the request of the Telephone Co. at Kingston, has granted an extension of the company's licence for three months only, in order to gain the necessary time to consider the purchasing of the company's property, with the view of extending the telephone system.

Mexico.—The Government Telegraph Department states that the offices at El Triunfo, Ensenada de Todos Santos, La Paz, San José del Cabo and Todos Santos, which are connected to Cerritos, in Sinalva State, by means of wireless, are to be considered as an extension of the ordinary telegraph facilities, and not as a wireless system.

Military Telegraphists.—The P.M.G. has sanctioned an arrangement under which the Royal Engineers will take charge of the engineering work of the telegraph in the south of Ireland, with a view to familiarising the men with the working of the system, so that in time of need they may be able to take over and work the telegraphs.

Telegraphic Interruptions:—

Port Arthur-Chifu	March 9, 1904
Pontianak-Saigon	Sept. 16, 1908
Tourane-Amoy...	Jan. 19, 1909
Malta-Zante	April 9—14, 1909

Wireless Telegraphy.—The Bureau International de l'Union Télégraphique announces that Persia and Portugal have ratified the Radio-telegraphic Convention, but have not recognised the additional engagement, which their respective delegates did not sign at Berlin.

The Bulgarian Government intends to install a Marconi wireless telegraph station at Varna, and a sum of 120,000 fr. has been voted for that purpose. The station is to have a radius of 600 km.

Wireless Telephony.—Experiments carried out between Paris and Melun with new apparatus invented by Lieuts. Colin and Jeance, of the French Navy, are said to have resulted in complete success over a distance of 30 miles.

Mr. Reginald Fessenden has recently been experimenting with a wireless telephone apparatus at Boston, and now announces that he has so far perfected the instrument that a message can be sent and received by battleships stationed 400 miles apart.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—May 31st. Two 4,700-K.V.A. turbo-alternators, with condensing plant, &c., and one 447-K.V.A. ditto, for the Council's electricity supply department. See "Official Notices" March 12th.

Belfast.—April 24th. Circulating pump and motor for the Laganbank Road pump house of the Tramways and Electricity Committee. See "Official Notices" April 2nd.

Belgium.—April 24th. The municipal authorities of Perwez are inviting tenders for the extension of the central electric lighting station.

Blackpool.—Cables for the Electricity Committee. See "Official Notices" March 26th.

Bradford.—April 28th. Cooling towers for the Corporation. See "Official Notices" April 9th.

Bristol.—April 19th. Arc lamp carbons and incandescent electric lamps, for the Docks Committee. W. W. Squire, engineer, Cumberland Basin.

Cleckheaton.—April 19th. Cables for the electricity department for the year. See "Official Notices" April 2nd.

Dublin.—April 20th. Sub-station switchboards and accessories for the Lighting Committee. See "Official Notices" April 9th.

April 30th.—Electrical works and supplies for the Commissioners of Public Works for their various buildings in Dublin and vicinity. Deposit £1. H. Williams, Secretary, Office of Public Works, Dublin.

Edinburgh.—April 16th. Underground conduits for the electricity supply department. See "Official Notices" April 2nd.

Fareham.—April 22nd. Electric supply mains, transformers and arc lamps and accessories for the Council. See "Official Notices" March 26th.

Glasgow.—April 26th. The T.C. electricity department invite tenders for one year's supply of gas and steam tubes and fittings. Mr. W. W. Lackie, engineer.

Limerick.—April 23rd. Stores for the Electricity Committee. See "Official Notices" to-day. Date, originally fixed April 16th, has been extended as above.

London.—Hackney.—April 22nd and May 6th. Arc lamp carbons for one year; also cables, troughing, &c. See two "Official Notices" March 12th.

Stepney.—April 22nd. Pipework, valves, centrifugal pumps, hot-well, &c., for the Electricity Supply Committee. See "Official Notices" April 2nd.

April 23rd.—Installation of telephones and fire-alarms at the South-Western Fever Hospital for the Metropolitan Asylums Board. See "Official Notices" April 9th.

Shipley.—April 27th. Electric invalid lift for Sir Titus Salt's Hospital. See "Official Notices" April 9th.

Sunderland.—April 29th. Cables for the Corporation tramways. See "Official Notices" April 9th.

Stockport.—Stores for the Electricity and Tramways Departments. See "Official Notices" to-day.

Swansea.—April 23rd. Motors and starting switches, for the Corporation. See "Official Notices" April 9th.

Wallasey.—April 19th. Battery, reversible booster, and switchboard for the U.D.C. electricity department. See "Official Notices" April 9th.

April 20th.—Stores for the Electricity Department. See "Official Notices" April 9th.

Waterford.—April 19th. Maintenance of telephones at the District Lunatic Asylum. G. J. Briscoe, Clerk.

Whitehaven.—Feeder pillars and lamp columns for the Corporation. See "Official Notices" to-day.

Woodbridge.—June 1st. The U.D.C. wants to hear from a company that would establish electric light works in its district, and light the streets electrically. See "Official Notices" March 26th.

CLOSED.

Accrington.—The Electricity Committee has accepted the tender of the Brush Electrical Engineering Co. for two double-deck cars and a single-deck one, to meet the requirements of the Haslingden section.

Bradford.—The Corporation tramways department has accepted the following tenders for scrap:—

F. W. Harris.—Two tons scrap copper wire.
Tom Dawson.—Scrap copper trolley wire, &c.
Marple & Gillott.—Scrap brass.
Alf. Barrans & Co.—Cast-iron brake blocks and miscellaneous scrap.
J. Hornby & Son.—Iron borings.

The tender of Messrs. Mountain & Gibson, Ltd., for six new car trucks, at £40 each, has been accepted.

Brighton.—The Lighting Committee has accepted the tender of the Phœnix Dynamo Co., Ltd., for a 300-kw. motor-generator, at £978.

British Columbia.—According to the *Canadian Electrical News*, the British Insulated & Helsby Cables, Ltd., have recently received the contract for the installation of over 7 miles of extra-high-tension cable on the lines of the Montreal Light, Heat & Power Co., also a contract for a large quantity of paper-insulated air-space telephone cables for the British Columbia Telephone Co.

Croydon.—The T.C. has accepted the tenders of J. H. Gilman & Co. for the annual supply of hard steam coal to the electricity undertaking, and of William Cory & Sons, Ltd., for small coal.

Dumbreck Works.—Messrs. Stevenson & McGuffie, consulting engineers, of Glasgow, have accepted the British Westinghouse Electric and Manufacturing Co.'s quotation of £4,120 for the supply and erection of one 300-kw. mixed-pressure turbine, d.c. generator, Le Blanc condenser and cooling tower, &c., to be erected in Messrs. Wm. Baird & Co.'s Dumbreck Works, near Kilsyth.

Glasgow.—The Tramways Sub-committee on Works and Stores has accepted the following tenders:—

Small Brooklyn insulators.—Loudon & Clark.
Porcelain insulators for switch pillars.—Taylor, Tunnicliffe & Co., Ltd.
Gear cases.—British Westinghouse Electric Co., Ltd.
"Brook-Hirst" starting gears.—Lancashire Dynamo and Motor Co., Ltd.
Rock asphalt mastic.—Currie & Co., Ltd.
Lead-covered cables.—British Insulated and Helsby Cables, Ltd., and Standard Cable Manufacturing Co., Ltd.

Inverness.—The North of Scotland Electric Light and Power Co. have secured the contract for the lighting of the new Territorial riding school, to be erected at the Citadel, Inverness.

London.—Stepney.—The B.C. has accepted the tender of the City Glass Co. for the annual supply of arc lamp globes (estimated amount £58).

Lowestoft.—The tender of Messrs. Hadfield's Steel Foundry Co., Ltd., for 12 tires, at £1 18s. 9d. each, has been accepted by the Corporation, which has also accepted the tender of the Lahmeyer Electrical Co. for cables for the ensuing year.

Maidenhead.—The T.C. has accepted the tender of Callender's Cable, &c., Co., Ltd., for cable, at £397.

Nelson.—The T.C. has accepted the tender of Messrs. J. Carter & Co., of Nelson, for the lighting of the fire station by electricity.

Oldbury.—The U.D.C. has accepted the tender of the Worthington Pump Co., Ltd., for a motor for driving the raking apparatus at the sewage disposal works, at £39 10s.

Portsmouth.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for feeder cables, at £425, and 2s. 8d. and 3s. 2d. per yard for additions and deductions. The next nearest was Johnson & Phillips, Ltd., at £431, and for additions and deductions 2s. 8½d. and 3s. 2d. per yard.

Rotherham.—The tender of Messrs. Dick, Kerr & Co., Ltd., of £4,597, for six double-deck cars with top covers, has been accepted by the B.C.

Salford.—The T.C. has accepted the following tenders for supplies for the tramway undertaking:—

Special car accessories.—British Westinghouse Co. (three years); W. Boydell & Sons, Ltd. (three years); Malleable Steel Castings Co. (three years).
Overhead equipment materials.—Watlington & Co. (one year); G. Hill & Co. (one year); British Insulated & Helsby Cables, Ltd. (one year); J. Russell and Sons, Ltd. (three years); Moston Malleable Castings Co. (three years).
Car accessories (mechanical).—W. Boydell & Sons, Ltd. (three years); R. & H. F. Phillips (three years); Malleable Steel Castings Co. (three years); John Hall (one year); Sunnybank Foundry Co. (three years); Gabriel & Co. (three years); Breckneil, Munro & Rogers (three years); Watlington & Co. (three years); L. Andrew & Co. (three years); Mountain & Gibson (three years); J. Baker & Co. (three years); British Westinghouse Co. (three years); Estler Bros. (three years); Johnson, Clapham & Morris (one year); G. W. Allsopp (three years).
Ears, frogs, pull-offs, &c.—G. Hill & Co. (one year); Watlington & Co. (one year); Johnson, Clapham & Morris (one year); Breckneil, Munro and Rogers (one year); Edward Dewhurst (three years); Tramway Supplies, Ltd. (three years).
Car accessories (electrical).—W. McGeoch & Co. (three years); John Hal (one year); L. Andrew & Co. (three years); F. Reddaway & Co. (three years); British Thomson-Houston Co. (one year); General Electric Co. (one year); Ward & Goldstone (three years); British Westinghouse Co. (one year); C. Macintosh & Co. (three years); Liverpool Electric Cable Co. (one year); British Insulated & Helsby Cables, Ltd. (one year); Edison & Swan United Electric Light Co. (three years); Gabriel & Co. (three years); A. Cort & Co. (three years); Stirling Varnish Co. (three years).

The following tenders have been accepted for annual supplies in connection with the electrical undertaking:—

Fire-bricks, fire clay, granite spar.—J. Hallett & Co.
Arc lamp globes.—Sloan Electrical Co.
Brass and gun-metal castings.—Thomas Anderson, Ltd.
Steel.—S. Pearce & Sons.
Iron.—Hall & Pickles.
Wrought-iron tubes and fittings.—Monks, Hall & Co.
Asbestos packing —Leyland & Birmingham Rubber Co.
Gravity type ammeters and circuit-breakers.—Eckstein, Heap & Co.
Firebars and general castings.—J. O. Latham & Co.
Maximum demand indicators.—Reason Manufacturing Co.
Motor carbon brushes.—Sloan Electrical Co.
Lead piping.—W. T. Glover & Co.

Stockport.—The T.C. has accepted the following tenders:

Bennis & Co.—Elevator (including rotary filler), £4 per ft.; conveyor, £1 10s. per ft.; driving gear, £25; tension gear, £10.
Babcock & Wilcox, Ltd.—Twelve weldless steel tubes, £15 2s. 6d.
Stewart & Lloyd.—Electrically-welded piping, £72 18s. 9d.
Lorain Steel Co.—Cross-over for tramway, £112.

Walsall.—The T.C. has accepted the tender of Messrs. Youngs to supply 56 jacks for the tramway undertaking, at £1 12s. 6d. each.

Watford.—The E.L. Committee has recommended the acceptance of the tender of Messrs. Kaye, Son & Co., Ltd., for the supply of coal, at 12s. 3d. per ton, which will mean a saving of £200 during the coming year in the cost of fuel. The quotation of the Lea Recorder Co. for a meter, at £80, was also accepted.

Wimbledon.—The T.C. has accepted the following tenders for supplies for the electric lighting undertaking:—

Western Electric Co.—Cables and conduits, high and low-tension cables, public lighting cables, house and lamp service cables and pilot wires.
Albion Clay Co. and Doulton & Co.—Conduits.
Callender's Cable Co.—Joint-boxes and jointing materials, compounds and tapes, and frames and covers.
W. Lucy & Co.—House cut-outs.
British Insulated & Helsby Cables, Ltd.—Other items.
British Westinghouse Co.—Transformers and meters.
Duckham & Co. and W. H. Willcocks & Co.—Oils.
General Electric Co.—Lamps, carbons and accessories, metallic-filament lamps.
W. Geipel & Co.—Carbons.
Siemens Bros. Dynamo Works, Ltd.—V.I.R. cables.
General Electric Co.—Accessories.
E. J. Shaw & Co.—Arc lamp globes.
Union Electric Co.—Flame arc lamp carbons.
Hall & Co., Croydon.—Firebricks and fireclay.

Yarmouth.—The T.C. has accepted the quotation of the British Electrical & Engineering Co., Ltd., for the supply of 18 gear wheels, at £2 15s. each, provided they are made of British steel, and the quotation of Messrs. John Baker & Co. for 60 steel tires, at £1 14s. 6d. each.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERBOSAN.—School; S. Hutchins, architect, Montgomery.
ABERDEEN.—Alterations at Oldmill Poorhouse; Brown & Watt, architects, 17, Union Terrace, Aberdeen.
ABERDEENSHIRE.—New steadings, houses, &c., on Haddo House Estates; C. G. Smith, factor, Haddo House, Aberdeen.
AMBLE (Northumberland).—Installation of suction gas producer plant or steam plant, to supply electricity for public and private lighting, for the U.D.C.; Mr. Gibson, surveyor to the Council, 94, Queen Street, Amble.
AMBLECOTE (near Stourbridge).—Proposed extensive engine sheds, for the Great Western Railway Co.
ANNFIELD PLAIN (Co. Durham).—United Methodist Church; A. T. B. Kell, architect, Front Street, Chester-le-Street.
ASHTON-UNDER-LYNE.—Alterations to servants' quarters at the infirmary; C. H. Jenkinson, architect, Albion Villa, Queen Street, Ashton.
ASPULL (near Wigan).—Shop and two houses, Woodfield Street; T. H. Platt.
ASTON MANOR.—Electrical sub-station in Alma Street, for the B.C.; F. Richardson, borough surveyor.
ATHERTON.—Warehouse; H. S. Fairhurst, architect, Spring Gardens, Manchester.
AYR.—Drapery premises, High Street (£1,600); Murdick & Lockhart, Sandgate, Ayr. Skating rink (£3,000); J. C. Reid, 209, St. Vincent Street, Glasgow.
BACUP.—Stables, Willington Hotel, Britannia, for J. Kenyon, Ltd., brewers, Rawtenstall. Additions to premises, Back Manor Street, for J. R. Pilling.
BALLYMONEY (Co. Antrim).—Proposed new Post Office.
BANFF.—Alterations of Rothiemay Public School; W. L. Duncan, architect, Turriff.
BANGOR (Co. Down).—Cottage hospital (£3,000); Young & Mackenzie, architects, 17, Donegall Square West, Belfast.
BARRY.—Proposed new theatre opposite the Hippodrome (£6,000 to £7,000); and enlargement of present building for use as public hall and skating rink.
BEVERLEY.—New Baptist Church and schools; Garside & Pennington, architects, Pontefract.
BASSENTHWAITE.—Waterworks pumping station (£2,000); J. B. Wilson, water engineer, Cockermouth.
BIRKENHEAD.—Engine and escape shed; C. Brownridge, Town Hall, Birkenhead.
BIRMINGHAM.—New school at Rounds Green, for the Oldbury Education Committee (1,050 children); A. Long, architect, 21, New Street, West Bromwich. New school at Langley, for the Oldbury Education Committee; F. J. Gill, architect, 236, Rolfe Street, Smethwick. Sheds at Harborne Wharf; H. E. Stilgoe, city engineer, Birmingham.
BIRTLEY.—Church (£10,000); Boyd & Groves, architects, Emerson Chambers, Newcastle-on-Tyne; Burnett & Son, builders, Newcastle-on-Tyne.
BISHOP STORTFORD.—New girls' school, for Herts and Essex C.C.'s (£6,200); J. W. Fisher, architect, Debdale Road, Wellingborough.
BLACKBURN.—Police quarters, Sessions house, &c. (£113,000); W. Stubbs, engineer, Blackburn Town Council. Forty dwelling houses (£10,000); Borough Engineer, Blackburn. Workmen's dwellings; Maxwell and Shaw, architects, Richmond Terrace, Blackburn.
BLAIRGOWRIE (Perthshire).—Alterations on Dirnanean mansion house; A. Hill, builder, Blairgowrie.
BLOXWICH.—Slaughter house, Samuel Street, for Boot & Bilson.
BRENTWOOD (Essex).—Probable rebuilding, after fire, of How Cross (mansion), South Weald; A. Upton, owner.
BRIGHTON.—Medical officer's residence for the B. of G.; B. Burfield, clerk, Princes Street.
BRISTOL.—Electrical installation at new school in Southwell Street, Kingsdown; W. S. Skinner, architect, Edinburgh Chambers, Baldwin Street, Bristol. Probable rebuilding, after fire, of premises, Redcross Street, for Wm. Brice & Co., cabinet manufacturers. Enlargement of central disinfecting station; T. H. Yabbicom, architect, 6, Queen's Square, Bristol.
BROADWATER.—Church; Baines & Son, architects, 5, Clement's Inn, W.C.
BURNLEY.—Alterations to business premises, 173, St. James's Street, for H. Latham, furnisher.
BURY.—Dining rooms and other additions at Bolholt Printworks, Woolfold, Bury; additions to Elton Cop Dyeing Co.'s Works.
BUXTON.—Mortuary buildings; W. H. Grieves, Town Hall, Buxton.
CAERLEON (near Newport, Mon.).—Six houses, Broad Walk, for S. Block, Newport.
CAMBRIDGE.—Repairs, after fire, at the Training College for Women Teachers, Wollaston Road; Miss C. H. Ellis, Bursar. Extension of sweet factory, for H. G. Whibley, Market Place (electric power to be used).
CANTERBURY.—Houses in South Canterbury Road; Amos & Foad, builders, Church Road, and 45, Oxford Street, Whitstable. Two houses, St. Augustine's Road; Clarke & Epps, builders, Maidstone.
CARDIFF.—Alterations at Ely Hospital, for the B. of G.; E. Seward, architect, Queen's Chambers, Cardiff.
CARLISLE.—Warehouse, Studholme's Lane, for Mr. Nichols; J. Leslie, architect.
CATTON (Norwich).—New Wesleyan Sunday School.
CHELTENHAM.—Alterations and additions to the Ladies' College, for the T.C.; Bank buildings, for the United Counties' Banking Co.; skating rink, Oxford Passage, for the Roller Skating Rink Syndicate.
CHERITON (near Folkestone).—Shop and stable, Harcourt Road, for H. Moody, builder, 35, Brockman Road, Folkestone.
COCKERMOUTH.—Alterations to Market Hall; T. B. Simmons, architect, Cockermouth.
COCKFIELD.—Stables; E. Hamilton, 2, New Road, Brighton.
COLCHESTER.—New Liberal Club premises, Headgate; Goodey & Cressall, architects, West Stockwell Street. Lavatory and cleakroom, Pelham's Lane, for the T.C.; T. J. Ward, builder, St. John's Street.
COLNE.—Proposed new works, to be electrically equipped, for H. Bronnert and Co., Manchester.
CONSETT (Co. Durham).—Primitive Methodist hall and class rooms; J. W. F. Phillipson, architect, Murton Chambers, 8, Grainger Street, Newcastle-on-Tyne.
COTFORD (Taunton).—Villas and colleges in asylum grounds, £926; I. Lodge, secretary, Cotford.
COTTINGHAM (near Hull).—New offices for the U.D.C.
COVENTRY.—Refuse destructor, for the T.C. (£6,474); Executors of Chas. Garlick, builders, Far Gosford Street, Coventry. Houses, Chapel Lane, for E. Kelley; Broomfield Road, for E. Twigg; Berkeley Road, for C. F. Woodall; Allesley Old Road, for Mottram & Sons; Oliver Street, for C. A. Newbold; Melbourne Road, for C. Spiers; Melbourne Road, for E. Stidworthy; Earlsdon Lane, for Orr Bros.; Albany Road, for T. R. Barton; Binley Road, for Mrs. M. E. Tyler; Westwood Road, for C. E. Needham.
CREWE.—Fifty-five houses, Ruskin Road, for W. H. Clews, builder. Sewerage scheme for the T.C. (£60,000); G. Eaton-Shore, borough surveyor.
CROYDON.—Eighteen houses, Sundridge Road; D. L. Gooch, 17, Everton Road. Five houses, Shirley Road; P. Crowley, Burlington Road, Disinfecting station on site adjoining Factory Lane; E. F. Morgan, surveyor, Croydon Town Council.
DARLINGTON.—Workshop, Westfield Street, for John Tinsley, Ltd. Mechanical laboratory, Technical College, for the Education Committee. Additions to the Darlington Club and Institute. Additions to St. Paul's Parish Room; Kitching & Lee, architects. Roller skating rink, Stanhope Street, for J. P. Pritchett & Son. Houses, Beechwood Avenue, for John Guthrie & Son; Lewes Road, for James Wallis; Crosby Street, for H. Walker; Woodlands Terrace, for G. Dickinson & Son; Bartlett Street, for Clark & Moscrop; Beechwood Avenue, for R. Blackett & Son, builders, Paradise Terrace. Houses, Falmer Road, for J. E. Chilton; Durham Road, for J. Cuthbertson; Upper Victoria Street, for J. W. Watson.
DARTMOUTH.—Villa residence at Swannaton, for J. Crocker; J. Back, builder.
DAVENHAM (Cheshire).—Additions to schools, for the managers; A. E. Powles, architect, 7, Winnington Street, Northwich.
DOLGELLY.—Additions to Dr. Williams's Schools, for the Governors (£2,000).
DOUGLAS (Isle of Man).—New Sunday schools for St. Andrew's Church; G. and W. R. Kaye, architects, Athol Street, Douglas. New church at Belle Vue, Laureston Road.
DUDLEY.—Church school; Mr. Hutchings, County Offices, Stafford.
DUNDEE.—Store for Homelight Oil Co., Ltd., Dundonald Street. Alteration to property for D. Hynd, Nelson Terrace. Alterations on shop, for J. M. Scott, Reform Street. Houses in Downfield and Pitkerro Road, for D. Robertson and Watt, Donald & Co.
EASTBOURNE.—Eight houses, Victoria Drive, for T. H. Sawyer & Son. Addition to Hydro, Mount Road, for the Hydro Hotel Co.
EASTRY (Kent).—Enlargement of the National schools; D. E. Hughes, Eastry.
ELLAND.—Warehouse at Lilly Dyeworks, for J. Ainley & Sons.
EMLEY (near Wakefield).—Alterations and additions to schools, for the West Riding of Yorks C.C.; County architect, Wakefield.
EXETER.—New Wesleyan Methodist Sunday schools in connection with St. Thomas's Church. Residences in Bawnfield Crescent; R. Challice, architect, Bedford Circus, Exeter.
EXMOUTH.—Large laundry, Rosebery Road, for G. Lewis, Montpellier Road; J. Carter, builder, Exeter Road. New shop, Park Road, for Mr. Kelly, 18, Park Road.

FALKIRK.—Extension to high school; A. & W. Black, architects, Falkirk.

FELTHAM (Middlesex).—Wesleyan Chapel, Hanworth Road. Rebuilding and extending workshops, for Pritchetts & Gold, 20, Victoria Street, S.W.

FOLKESTONE.—Detached villa in Turketel Road; A. Bromley, architect, Folkestone; F. Nicholls, builder, Folkestone. Additions to Hundert's Hotel, Bouverie Road West; H. Videan, architect. Alterations and additions to 2, 3 and 4, Westbourne Gardens; C. Jenner, builder, 49, Broadmead Road.

GATESHEAD.—New lunatic asylum; Town Council.

GLASGOW.—Warehouse and offices in Coburg Street, for the Kinning Park Co-operative Society, Ltd., 6, Ardgowan Street; motor garage, workshop and showroom in Victoria Road, for R. Stein, engineer, 165, Holmlea Road; alterations to Zoo and Hippodrome, for E. H. Bostock, Scottish Zoo and Hippodrome, East City Road; alteration to building in David Street, Camlachie, for the Camlachie Conservative Association; new buildings, and alterations in Castle Street, for the Royal Glasgow Asylum for the Blind.

GLOSSOP.—New Liberal Club premises, Norfolk Square.

GOOLE.—Dock developments; L. and Y. Railway Co., Hunt's Bank, Manchester.

GREENOCK.—New U.F. Church and hall for the Mount Pleasant congregation (£2,900).

HALIFAX.—Probable developments and additions at Atlas Carpet Works; Balme & Pritchard, dyers and finishers.

HANLEY.—Six houses, Woodhead Road; E. Roberts. Additions to premises, 307, Leek Road; G. Bebbington.

HARLESDEN.—Temporary fire station and quarters; O. C. Robson, surveyor, Willesden U.D.C.

HASLINGDEN.—Farm house, for the B.G.; Mr. Brocklehurst, architect, Waterfoot, Rawtenstall.

HEREFORD.—Alterations to business premises, 1, Bridge Street, for Miller and Steward, jewellers.

HINDSFORD (Tyldesley).—Important additions to St. James' R.C. day schools; County Architect, Preston.

HOLBEACH.—Isolation hospital (£1,000).

HORNCHURCH SOUTH.—Thirty houses on New Estate, for Mr. Gower.

HOUNSLOW.—New station in Kingsley Road; J. Carter, Secretary to the District Railway.

HULL (Wilmington).—Goods offices for the North-Eastern Railway; W. Bell, company's architect, York.

HULME.—Extensions to Grammar School; W. C. Hardisty, architect, 5, John Dalton Street, Manchester.

INVERNESS.—Additions and alterations to Dalcrombie Lodge; T. Noble, estate office, Aldourie.

KIDDERMINSTER.—Bungalow at Dowles, for J. H. Woodhouse; villa residence, Oldnall Road, One Tree Hill, for R. C. Gudgeon.

KILMALLOCK (Kilfinane).—Additions to the Girls' National Schools; B. E. F. Sheehy, architect, 57, George Street, Limerick.

KINGSTON-ON-THAMES.—Prospective re-building, after fire, of the Albany Club.

KIRKCALDY.—Mission buildings in Coal Wynd, in connection with St. Bryedale U.F. Church (£1,500); W. Williamson, architect, 252, High Street, Kirkcaldy.

LANCASTER.—Houses, Bridge Road, for R. Baines & Co.; Westbourne Road, for W. Higginson; Sibsey Road, for E. Parkinson; Ardengate, off Church Avenue, for R. Robertson.

LEATHERHEAD.—New school (400 children), for the Surrey Education Committee.

LEYLAND (near Preston).—Houses, George Street, for Mr. Moss; Church Road, for M. J. Wilkinson.

LISCARD (Cheshire).—Extension to engine house at the Wallasey U.D.C. electricity works, Seaview Road; electrical engineer, Seaview Road.

LITTLEHAMPTON.—Eleven houses in Maxwell Road, for G. Gray.

LLANWINIO (near St. Clears, Carmarthenshire).—Vicarage for Rev. E. A. Davies; C. S. Thomas, Meager & Jones, architects, Wind Street, Swansea.

LIVERPOOL.—Rubber factory; T. Hulme, Royal Insurance Buildings, North John Street, Liverpool.

LONDON (W.).—Shop premises, Marylebone Lane (£796); Chown & Sheffield, architects, 2, Princes Street, Hanover Square, W.; B. E. Nightingale, builders, Lambeth.

(Hornsey, N.).—Ten dwelling houses, Hornsey Lane Gardens; J. C. Hill, builder, 88, St. George's Terrace, Kensington, S.W.; hall, rear of Manor House, High Street; T. W. J. Cutlan, builder, Glenn Lynne, Muswell Avenue, N.

(Muswell Hill, N.).—Five houses, Midhurst Avenue, for F. J. King, Surbiton.

(Bermondsey, S.E.).—Technical College, Tower Bridge Road; Dove Bros., Ltd., builders, Wesleyan Methodist Hall, Westminster, S.W. Addition to premises in Crimscott Street, for E. Lazenby and Son, Ltd.

(St. Pancras, N.W.).—Building in Georgiana Street; W. Nisbet Blair, engineer, St. Pancras Borough Council.

(E.C.).—Alterations, &c., to Sir John Cass's Technical Institute, 31, Jewry Street, Aldgate, for the Governors; restoration, after fire, of portion of 9 and 11, Leather Lane, occupied by E. A. Page; restoration, after fire, of portion of 89, Fleet Street, occupied by Messrs. Pooley, weighing machine makers.

(Hackney, N.E.).—Building in Mare and Valette Streets; H. Offer, estate agent, 81, Elizabeth Street, Eaton Square, S.W.

(Islington, N.).—Alteration to 61, Tollington Park, for D. de Meza and Son.

(King's Cross, N.).—Restoration, after fire, of cattle food factory in All Saints Street, for Messrs. Thorley.

(Peckham, S.E.).—Probable rebuilding, after fire, of Nelson Works, Bianca Road, for J. Hathaway & Co., trellis and pole manufacturers.

(Lower Edmonton, N.).—Roman Catholic elementary school (300 children).

(South Kensington, S.W.).—New building for Mining, Metallurgy and Geology in Prince Consort Road; Sir A. Webb, architect, 19, Queen Anne's Gate, Westminster, S.W.

(Lewisham, S.E.).—Buildings in Manwood Road; J. W. Webb.

(Greenwich, S.E.).—Houses in Hervey Road, Blackheath; Robertson and Co. Two houses, Westcombe Park Road; J. S. Heath, architect, Mitre Court Chambers, Temple, E.C. Extension to premises of the Delta Metal Co., Blackwall Lane.

(Clapham, S.W.).—Nurses' Home at the Infirmary, Wandsworth Common; J. S. Gibson, architect, 5, Old Bond Street, W.

(S.W.).—New Hotel Goring, and shops, in Buckingham Palace Road; J. E. Trollope, architect, 28, Craven Street, Strand, W.C.

(Strand, W.C.).—Buildings in Catherine Street and Exeter Street; G. H. Fox, architect, 9, John Street, Adelphi, W.C.

(Old Ford, E.).—Buildings in Blondin Street; F. R. Hasluck, architect, 23, Bush Lane, Cannon Street, E.C.

(Harrow Road, W.).—Ice factory at Kensal Wharf, for Gatti, Stevenson and Slaters, Ltd.; H. P. Drew, architect, 33, King Street, Covent Garden, W.C.

LONDON (Streatham, S.W.).—Four houses in Wyatt Park Road; Chapple and Utting.

(Wandsworth, S.W.).—School in Hitherfield Road (£10,117); Galbraith Bros., builders, 46, Camberwell Green, S.E. Housewifery centre at Tooting Graveney; T. J. Bailey, L.C.C. Education Architect, Victoria Embankment, E.C.

(Rotherhithe, S.E.).—Alterations, St. Mary's National Schools, Lower Road; Battley, Sons & Holness, builders, 21, Old Kent Road, S.E.

(Commercial Road, E.).—Re-erection of 15, 17 and 19, Berner Street; H. T. Bromley.

(Palmer's Green, N.).—Congregational school church (£1,530); Baines and Son, architects, Clement's Inn, W.C.; Mattock Bros., builders, Winkfield Road, Wood Green, N.

(Lewisham, S.E.).—Twelve houses, Merchiston Road and Highclere Street, also two motor sheds; Norfolk & Prior, architects, 4, Station Buildings, Catford Bridge, S.E. Five houses, Thornwood Road; W. J. Soudamore & Sons, builders, 13, Manor Lane, S.E. Eleven houses, Arran Road; J. Watt, builder, The Lodge, Bromley Road, S.E.

(Barking, E.).—Four houses, Back Lane, for Smith, Garrett & Co., Bow Brewery, Bow, E.; eighty-four houses, Gordon Road, Kennedy Road and Strathfield Gardens, for A. Blake.

(Wimbledon, S.W.).—Additions to "The Homestead," Burghley Road; Whitehead Bros., builders, 21, Hill Road, Wimbledon. Extensions to Raynes Park laundry, Worple Road; Hawes & Co., estate agents, Wimbledon. Additions to Technical Institute, Gladstone Road; Jarvis & Richards, builders, 9, Queen Anne's Gate, S.W.

(Mill Hill Park, W.).—New station; J. Carter, secretary to District Railway.

LONGFORD.—Probable rebuilding of workhouse, after fire.

MAESTEG (Glam.).—New school at Cwmfelin; T. M. Franklen, clerk to the C.C., Cardiff.

MAGUIRESBRIDGE (Co. Fermanagh).—New glebe house contemplated (£1,000).

MAIDENHEAD.—Additions to La Chaumiere, Fishery Estate, for West Neve. Houses, Braywick Road, for F. Trinder, and C. R. Snell.

MALAHIDE (Co. Dublin).—Carnegie library; A. Scart & Sons, architects, 34, Lower Sackville Street, Dublin.

MANGOTSFIELD.—School; R. S. Phillips, architect, The Cross, Gloucester; E. Love, builder, 127, Hampton Road, Redland, Bristol.

MARKET HARBOROUGH.—Additions to hosiery factory, for Hearth & Co.; house and shop, Church Square, for T. B. Hunt, fishmonger, 8, Church Square.

MATLOCK.—Operating theatre, Whitworth Hospital; E. Dawson, architect, Matlock.

MEDOMSLEY (Co. Durham).—Elementary schools for the C.C.; J. J. Eltringham, architect, Blackhill; Clerey & Charlton, builders, Sunderland.

MELTON MOWBRAY.—Two villas, Park Road, for Ernest Clarke.

MENMUIR (Forfarshire).—Proposed parish hall; W. L. Spalding, Balconnel, Menmuir.

MIDDLETON (Lancs.).—New school, for the T.C. (£7,725).

MOSSLEY.—Two new schools in Mill Lane; J. Hyde, town clerk, Mossley (architect not yet appointed).

NESTON (Cheshire).—New Congregational Church; J. L. Simpson, architect, 8, Cook Street, Liverpool.

NEWHAVEN.—Remodelling the old boys' school, South Lane, to accommodate 330 infants, and alterations to the girl's school (£550).

NEWMARKET.—Probable rebuilding, after fire, of Exning House, residence of Col. E. W. D. Baird (£20,000 damage).

NEWPORT (Mon.).—Bath house, for 16 shower baths, for the T.C. (£2,000).

NOTTINGHAM.—Alterations to factory, Mount Street, for the T.C.; F. B. Lewis, city architect, The Guildhall, Nottingham.

NUNEATON.—Public slaughter-house for the T.C. (£1,248); Mr. Hickman, builder, Market Harborough.

OLDBURY.—Primitive Methodist Church, McKean Road; F. W. B. Yorke, architect.

OLDHAM.—Renovation, after fire, at the Castle Mill, Hathersham.

OSSETT.—Primitive Methodist school; J. B. Thornley, architect, High Street, Darwen.

PAISLEY.—Sunday school halls, for Coats' Memorial Church (6,000); Session Clerk, Coats' Memorial Church, Paisley. Five tenement houses at Whitehaugh Drive, Paisley; C. Hunter, cooper, Paisley. Two four-storey tenements, 67 and 68, George Street, Paisley; R. Adam, wine and spirit merchant, Paisley.

PARBOLD (Lancs.).—New premises for Manchester and Liverpool District Banking Co.; F. W. Finchett, architect, Ruff Lane, Ormskirk.

PENCLAWDD (Glam.).—New Congregational Church (£4,000); W. B. Rees, architect, 3, Dumfries Place, Cardiff.

PENCOED (Glam.).—Alterations and additions to school; T. M. Franklen, clerk to the C.C., Cardiff.

PLYMOUTH.—Houses on Pound's Estate; Secretary, Plymouth and District Industrial Co-operative Society, Frankfort Street. School, workshops and lavatories; Plymouth Education Authority. Houses at Laira; Secretary, Co-operative Society, Frankfort Street, Plymouth. Workshop; W. E. Blake, Commercial Road.

PORTMADOC.—New church at Borth-y-Gest (£2,000).

PORTRUSH.—Winter gardens, skating rink, &c.

PORTSMOUTH.—Alterations to police premises for the T.C.; Borough Engineer.

PUDSEY.—School (£6,000); W. Shackleton, architect, Manor House Street, Pudsey.

READING.—House, Warwick Road; Webb & Sutton, architects. Public lavatories, for the T.C. (£770); G. S. Lewis & Brother, builders, 65, Castle Street, Reading.

RISCA (Mon.).—New school (250 infants); C. Dauncey, secretary to the Education Committee, Council Offices, Newport.

ROMFORD.—Building for Roneo, Ltd., 26, Holborn Viaduct, E.C.

ROTHERHAM.—Warehouse, Lincoln Street, for the Masboro' Equitable Pioneer Society; additions to workshops, Meadow Hall Road, Kimberworth, for Heyland Bros. Twenty-one houses and one shop; C. Green & Sons, builders, 174, Wellgate, Rotherham.

ROTHESAY.—Proposed new school; Clerk, Rothesay School Board.

SADDLEWORTH.—Garden suburb scheme for the Greenfield Co-operative Society; Wm. Foster, builder, Oldham.

ST. ANDREWS.—New stables and offices in Largo; Town Clerk.

ST. AUSTELL.—New Technical Institute (£2,250).

ST. LEONARDS.—Alterations to business premises, for Emmersons, ironmongers, 30, London Road.

ST. PETERS (Kent).—E.L. installation at St. Peter's Parish Church.

SALFORD.—Alterations to Woodbine Street School; O. Duthie, secretary, Salford Education Committee. Institute, Bank Lane, Pendleton.

SALTBURN.—Primitive Methodist Church building scheme (£5,400).

SEAFORD (Sussex).—Probable re-instatement, after fire, of the Wellington Hotel; N. Stedman, licensee.

SHEFFIELD.—New Wesleyan Methodist church at Darnall (£2,500).

SHEPTON MALLET.—Isolation hospital; J. C. Morland, Glastonbury.

SOUTHAMPTON.—Five houses, Portswood Road; S. C. Greenwood, architect, 11, Portland Street, Southampton.

STAFFORD.—New buildings and machinery at waterworks; W. Blackshaw, borough surveyor, Stafford.

STANDISH (near Wigan).—Four villas, Wigan Road, for J. Pennington, Wigan.

STANTONBURY.—Working men's institute near St. James' Church (£1,700); Rev. A. N. Guest.

STOCKTON.—Dairy, Cowpen Bewley, for F. Smith; two houses, Norton, for Benson Bros.

STOKE (Somerset).—Wesleyan Church; F. La Trobe, architect, 44, Corn Street, Bristol.

STOKE-ON-TRENT.—Parish hall; A. R. Wood & Co., architects, Burslem.

STOURBRIDGE.—Conversion of premises, High Street, into shops, offices, &c., for S. Fiddian.

STOURPORT.—Proposed Territorial drill hall.

STRETFORD.—Extensions to Technical Institute; E. Worrall, surveyor, Stretford.

SUNDERLAND.—St. Gabriel's Church; C. A. Clayton-Greene, architect, Norfolk Street, Sunderland.

SUTTON-IN-ASHFIELD.—Engine house and pumps; W. Burn, architect, Sutton-in-Ashfield.

SUTTON (Surrey).—Twenty-eight houses, Chalk Pit House Estate, for Sir Geo. Smallman; three houses, Benhill Road, for Mr. Richards.

TADWORTH (near Epsom).—Proposed new church (£5,000); Rev. A. J. Wethered, M.A., vicar.

TAUNTON.—Improvements (including new organ) at Victoria Street Wesleyan Methodist Church (£450). Additions to G.P.O. sorting depôt; Mr. Knight, postmaster. Rebuilding of corn and flour stores, after fire, for G. Small, Station Road.

TONBRIDGE.—Additions to works, Barden Road, for the Eyre Smelting Co., Ltd. Houses, Woodlands Road, for B. Butler. Additions to 5, The Terrace, for A. H. Neve, solicitor.

TONYREFAIL (Glam.).—New school at Gellidawel; T. M. Franklen, clerk to the C.C., Cardiff.

TREALAW.—New school; J. Rees, architect, Hillside Cottage, Pentre.

TUNSTALL.—Wesleyan chapel and schools at Sandyford (£2,000); H. Dain, architect, 116, High Street, Tunstall.

UTTOXETER.—Alterations at the Grammar School.

WAKEFIELD.—Additions to Grammar School; Simpson & Firth, architects' Southgate Chambers, Wakefield.

WALSALL.—Drill Hall for the 5th Batt. South Staffs. Regiment (Territorial Force) (£3,000); Hickton & Farmer, architects, Bridge Street, Walsall. Alterations and additions to shop premises, Wisemore, for John Smith, Ltd.; additions, Malt Shovel public house, Birmingham Road, for J. Lord; parsonage house, Dale Street, for Rev. Hon. S. J. W. Maitland; shop premises in Freer Street, for Dale and Bradnock. Three houses, Tasker Street; W. Kendrick & Son, builders, Tasker Street, Walsall. Seven houses, Victoria Terrace, Ryecroft; T. H. Jones, builder, Portland Street, Walsall.

WARRINGTON.—Proposed extensions to baths, Administrative Block at Sankey Sanatorium; Weights and Measures Office, &c. School, Evelyn Street; T. Longden, surveyor, Warrington Town Council. Ten houses, Thelwall Lane; T. Hewitt, builder, Hewitt Street, Warrington. New works, Kerfoot Street, for the Lynton Wheel and Tire Syndicate, Ltd.

WATFORD.—Additional buildings, Queensbury Lodge, Aldenham, for the Lister Institute of Preventive Medicine, Chelsea Bridge Road, S.W.

WATTSTOWN (Glam.).—Extension of Aberllechan school, for the Rhondda U.D.C.; J. Rees, architect, Hillside Cottage, Pentre.

WELLS.—Additions and improvements in form buildings, &c., at Asylum; F. Spencer, Chairman of Committee, Oakhill, Bath.

WEDNESBURY.—Conveniences, Market Place; E. M. Scott, Council engineer, Wednesbury.

WEST HARTLEPOOL.—New Empire Theatre in Lynn Street; W. & T. R. Millburn, architects, Fawcett Street, Sunderland.

WICKLOW.—New Post Office.

WIGAN.—Four houses in Northumberland Street; A. Sharples, builder, Essex Street, Wigan. Extensions to generating station.

WILLIAMSTOWN (Rhondda).—New vestry, classrooms, &c., at Saron Welsh Congregational Church; W. D. Thomas, architect, Tydfil House, Porth, Glam.

WORTHING.—Eight houses, Kingsland Road, Broadwater, for A. F. Clarke; H. M. Potter, architect, Worthing. Five, Kingsland Road, Broadwater, for F. H. Twine, Worthing.

WINCANTON.—Isolation hospital; J. C. Morland, Glastonbury.

WOKINGHAM.—Houses, Station Road, for A. T. Scott; Willington Road, for W. W. Read; Langborough Walk, for J. Beckenham.

WREXHAM.—New schools for the T.C.; Burrell & Willey, architects, Market Place Chambers, Durham.

The Victoria Falls and Transvaal Power Co.—

Mr. George Verity writing to the *Times* of April 10th regarding the prospectus of the above company says:—"This company mentions in its prospectus the expectation of supplying some millions of units of current to the different mines and stations in South Africa. This means that thousands of pounds will have to be spent by the users of the current in motors, arc lamps and switchgear, and it is a well-known fact that in cases where central stations have been put down by German and American manufacturers the difficulty of English manufacturers securing orders for the above is immeasurably increased. Any manufacturing engineer in the electrical industry can tell you of this difficulty which exists, and which almost amounts to a boycott, in South America, where the central stations are in the hands of German and American companies, and if the same thing is to be extended to South Africa the outlook is indeed a poor one for the thousands of operatives in the Midlands and the North who are engaged in the manufacture of electrical supplies. If the company owning the station is a German one we cannot grumble, but can only regret that our English financiers did not seize the opportunity of developing this valuable field; but if the company be an English one such as the one in question, it is, as Mr. Rich points out, a very serious matter, as, as he remarks, 'given financial support, open contracts and fair play, we British manufacturers have nothing to fear with reference to price or quality from any foreign country.'"

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, April 17th.—At 3 p.m. Visit to the Chingford Reservoir Works of the Metropolitan Water Board.

Tuesday, April 20th.—At 7.30 p.m. At the Royal United Service Institution. Paper on "Systems of Electrical Power Distribution," by Mr. C. H. Smith.

Saturday, April 24th.—At 3 p.m. Visit ss. *Otaki* at Victoria Docks.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, April 21st. At 7.30 p.m. At the University, Birmingham. Paper on "The Manipulation of Telephone Dry-Core Cables," by Mr. F. G. C. Baldwin; and paper on "Improvement of Power Factor in A.C. Systems," by Mr. M. Walker, to be abstracted and discussed.

Institution of Electrical Engineers (Leeds Section).—Wednesday, April 21st. At 7.15 p.m. At the University, Leeds. Annual general meeting.

Institution of Electrical Engineers (London).—Thursday, April 22nd. At 8 p.m. At the Institution of Civil Engineers. Conclusion of discussion on Mr. J. H. Rider's paper on "The Electrical System of the L.C.C. Tramways."

Institution of Mechanical Engineers.—Thursday, April 22nd. At the Hotel Cecil. Anniversary dinner.

Friday, April 23rd.—At 8 p.m. Presidential address.

Royal Institution.—Friday, April 23rd. At 9 p.m. Paper on "Tantalum and its Industrial Applications," by Mr. A. Siemens.

Physical Society.—Friday, April 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "Want of Symmetry Shown by Secondary X-Rays," by Prof. W. H. Bragg and Mr. J. L. Glasson; "Transformations of X-Rays," by Mr. C. A. Sadler; and "The Theory of the Alternate-Current Generator," by Prof. T. R. Lyle.

Institution of Civil Engineers.—Friday, April 23rd. At 8 p.m. Students' meeting. Paper on "The Development of Hydro-Electric Power Schemes, with Special Reference to Works at Kinlochleven."

Inquiry.—Makers of the "Empire" blower are asked for.

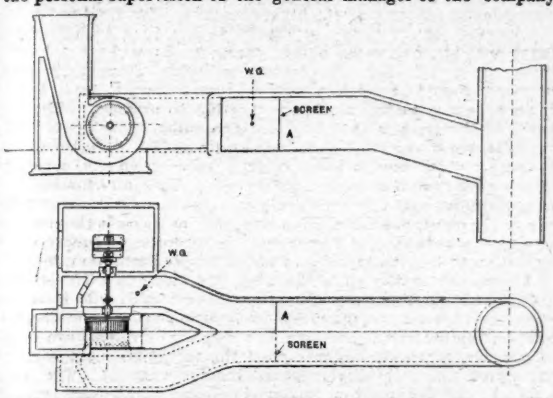
NOTES.

The Engineer and the People.—We have already referred in these Notes to the paper on this subject read by Mr. M. L. Cooke before the American Society of Mechanical Engineers. In the course of the discussion, Mr. Oberlin Smith said:—"It is true that engineers as a body live too much to themselves and for their work, and do not sufficiently affiliate with the public in general. Perhaps we are too busy and too modest to attend to anything but our own work, or to exploit ourselves before an admiring public. The present condition is partly our own fault; and I would here urge, as I have in an annual address upon a previous occasion, the higher self-cultivation of all engineers, in whatever branch of the profession. It is much to be regretted that, with the exception of West Point and Annapolis, few of our colleges, and still less our technical schools, pay enough attention to this matter. In furtherance of these ideas, would it not be a wise policy for this society to urge upon the technical schools of our country the adoption of broader and more liberal schemes of education, especially during a student's earlier years, that he might be caught (and taught) young? From another point of view, the public at large are to blame for not more thoroughly cultivating and recognising engineers as the men who are creating, developing and maintaining the whole fabric of modern civilisation. Many of them are doing splendid work in musty offices and drafting rooms for very moderate salaries, while the men who are exploiting and financing this work (with much less education, and in many cases smaller brains) are getting the big salaries and enjoying the credit of developing great industries and inaugurating public works. This public has not yet even learned, in many cases, the difference between the machinist who shapes the iron into a steam engine, or the engineman who oils and cleans it and watches it run, and the professional engineer who, with the necessary ability, education and experience, has designed it. Surely it is to be hoped that our nomenclature will be improved in this respect, that we either will drop the name of engineer or try in earnest to limit it to professional men, using other names for the entirely different lower grades just mentioned. It is also sincerely to be hoped, and, I think, with a good chance of early realisation, that professional engineers, with their carefully trained minds, their years of experience in administrative work and their logical habits of thought, may occupy more of the public places of our land. Knowing what our profession is and does, it seems remarkable that it is not more often represented in the halls of Congress, in the Cabinet, and even in the White House."

Reversion to Type.—We have often observed in recent years the remarkable tendency of modern electrical practice to return to early forms of apparatus, and to revive ideas which were evolved in the dawn of electrical engineering. The knife switch, toothed armature cores, and commutating poles, and metallic-filament-lamps, are all old types, tried and abandoned years ago, but now in universal use; and in the disk arc lamp, of which a description appears on another page of this issue, we have a further example of this reversion to type, for in the year 1845 an arc lamp employing circular disks of carbon, which were kept in rotation by clockwork, was invented by Thomas Wright. This was, we believe, the very first arc lamp, and, needless to say, proved unsuccessful. We hope that a better fate may be in store for the lamp devised by Messrs. Legge & Scott, in which a new kind of mechanism is employed.

A Siemens Works' Staff Dinner.—Mr. J. Eaton-Shore, shop superintendent, presided at the second annual dinner of the shop officials and foremen at Siemens Bros.' Dynamo Works, at the Institute in Tipping Street, Stafford. It was the first function of its kind attempted at the Institute. About 100 were present, and the arrangements were carried out by the Committee, Messrs. Briggs, Rathbone and Saunders, with Mr. F. E. Read as hon. secretary. The toast of "The Firm" was proposed by Mr. Kilpatrick, supported by Dr. Kloss, and Mr. Koettgen, managing director, of London, responded, and spoke very encouragingly of the future prospects of the Stafford works. Mr. Palairet proposed "The Guests," and Mr. Kieffer, the Stafford manager, had a very cordial reception in responding to the toast. "Siemens Institute" was proposed by Mr. C. M. Toplis, and Mr. Read replied. During dinner the Institute orchestra rendered selections of music, and a programme of songs, duets, &c., followed the repast.

Test of Electrically-Driven Sirocco Mine Fan.—A test was recently made of the Sirocco mine fan installed at the No. 6 pit of the Glamorgan Coal Co., at Llwynypia, particulars of which may prove of interest to our readers. It was carried out under the personal supervision of the general manager of the company,



Sketch showing Arrangement of Sirocco Fan.

Mr. Leonard Llewellyn, with instruments carefully calibrated for the occasion. The fan is of the double inlet type, 11 ft. 8 in. in diameter, and is direct-coupled to a three-phase motor made by the British Thomson-Houston Co. The figures given below represent the average of three tests:—

Speed of fan and motor	183 R.P.M.
Water gauge in fan drift	6 in.
" main drift	6 in.
Average velocity of air	1,842 ft. per min.
Area of drift	184·6 sq. ft.
Volume of air	340,033 cb. ft. per min.
H.P. input at motor	420 H.P.
Efficiency of motor	93 per cent.
B H.P. on fan shaft	390
I.H.P. in air	321·5
Mechanical efficiency of fan	82·43 per cent.
Combined mechanical efficiency of fan and motor	76·6 per cent.

The accompanying sketches show clearly the position of the water gauge, as well as that of the screen (A), where the air measurements were made. It is worthy of notice that the fan was capable of maintaining the water gauge in the drift when running at the low peripheral speed of 6,705 ft. per min.

An Electrical Ferry Boat on the Rhine.—Since July, 1908, an accumulator-driven electrical ferry boat has been in successful operation between Godesberg and Niederdollendorf, on opposite sides of the 400-metre wide channel of the Rhine. The boat was built by Messrs. Berningham, of Duisburg, and the electrical installation was carried out by the Felten and Guilleaume-Lahmeyer Werke. Passenger, cattle and goods traffic is dealt with. It is a steel twin-screw boat, and either screw alone is capable of propelling the vessel, at reduced speed, in case of accident.

The length is 30 metres, and a projecting platform, 15 metres × 9·5 metres, is provided to enable the largest wagons, &c., to be shipped. The maximum width is 8 metres, and the height to the iron deck is 1·9 metres. The depth in the water when fully loaded is ·85 metre, and the carrying capacity is 645 passengers. On deck are the anchor hoists, mast, platform for wagons, passenger saloon, steering house, and below deck are the collision chamber, mess room, machine room, accumulator room, captain's cabin and lavatories. The deck is provided with loading cranes, and with a landing bridge on each side.

A well-ventilated accumulator room lies under the platform. It contains 160 cells in ebonite cases, every 10 cells being held in a wooden tray. The capacity is 335 ampere-hours on a 1-hour discharge at 290 to 300 volts. The maximum charging current is 162 amperes, the charging voltage being 320 to 440 volts. The battery is carefully stayed in position on a lead-lined solid floor.

Two totally-enclosed 3-H.P. motors are mounted in the battery room for operating the landing bridges.

Behind the accumulator room is the propeller motor room, containing the two main motors and the charging switchboard. The motors are of 50 H.P., 300 volts, 300 R.P.M., and are series wound, of the open type, and fitted with commutating poles. Each can be worked quite independently forwards or backwards.

Complete control of the propeller and landing bridge motors is obtained from the steering house.

The charging of the battery is carried out from the Godesberg electricity works by means of a flexible cable ending in a plug connection. If desired, the energy used in a double journey can be recharged in a few minutes at the Godesberg landing stage, but this is unnecessary, as the battery was specified to be capable of making at least six double journeys when fully charged, and on test it was found easily possible to make more than eight double journeys. The results of several months' meter readings show that the average charge required for a single journey is 4·3 KW.-hours, whilst the motor input for a single journey is 3·2 KW.-hours. During the month of October, 1908, the traffic dealt with amounted to 52,000 passengers, 1,174 ordinary wagons, 307 power wagons, and 247 animals, this being an increase of some 60 per cent. on the corresponding period of the previous year, when the ferry was operated by benzine engine boats. The tariff is 10 pf. (1·2d.) per person, 25 pf. (3d.) for a horse or mule, 12 pf. (1·44d.) for cattle, and proportionately lower for smaller animals; loaded carts or wagons, 6d.; unloaded carts or wagons, 3d.; motors-cars from 6d. to 1s. The regular service from April 1st to September 30th is a 20-minute one, from 6 a.m. to 10 p.m.; and from October 1st till March 31st it is a 30-minute one, from 7 a.m. to 8 p.m. There is also a night service at 2-hour intervals. The maximum speed of the boat in still water is about 7½ miles per hour, and the motors are in use for from 2 to 3 minutes in each journey, each developing about 50 H.P.

The following particulars of the first cost of upkeep are given:—Cost of boat, £3,550; electrical installation, £2,000; landing stage, &c., £2,550; making a total of £8,100. Annual charges:—

Interest at 3½ per cent. on £8,550	£320
Depreciation on ship's body at 2 per cent.	71
" " battery at 10 per cent.	150
" " rest of electrical outfit at 4 per cent. ...	20
" " landing stage, &c., at 2 per cent.	51
Salary of steersman	75
" " switchboard attendant and ticket collector ...	75
" " extra attendant	50
Occasional extra steersman	15
Energy consumption for 12,000 single journeys = 52,000 KW.-hours at 1·8d. per KW.-hour	390
Maintenance, management, cleaning material, &c.	102
Total annual charges	£1,319

To cover these, each journey must, therefore, bring in about 2s. 3d., and the existing traffic shows that this will easily be exceeded.—*E.T.Z.*

Institution and Lecture Notes.—Metropolitan Association of Electric Tramway Managers.—The members of this Association held their usual meeting at the Municipal and County Club, Whitehall, S.W., on Friday evening, the 2nd inst., those attending being: Messrs. H. E. Blain (West Ham), (Chairman), A. Coveney (Erith), W. E. Hammond (Metropolitan Electric), H. L. Howard (Barking), F. Schofield (Leyton), W. C. Ullman (East Ham), A. V. Mason (South Metropolitan), C. Mittelhausen (Bexley Heath), and T. B. Goodyer (Croydon), hon. secretary. The hon. secretary reported he had received a further letter of an interesting character from Mr. James Rowlands, M.P., respecting the issue of composite licences to motormen and conductors holding the two licenses. He (Mr. Rowlands) had recently addressed a question in the House of Commons to the Home Secretary inquiring whether a decision had yet been arrived at regarding the issue of a composite licence, and had received the gratifying reply from Mr. Gladstone that the Commissioner of Police hoped to issue from May 1st next the composite licence asked for. The members received this intimation with much pleasure, as the concession in question was one that had been pressed for by deputation to the Home Secretary and the Commissioner of Police, and had been the subject of negotiations for some three years past, and it was unanimously decided to express the best thanks of the Association to Mr. Rowlands for his efforts in the matter. The recent letter from the Commissioner of Police regarding disabled cars was discussed, as were also various other matters, and the hon. secretary was requested to send letters accordingly. It was decided to hold the next meeting of the Association on Friday, June 11th next, and to accept the invitation of Mr. Hammond to pay a visit to the Metropolitan Electric Tramways system.

Institution of Electrical Engineers (Glasgow Section).—On Tuesday a paper on "Electricity Works and Refuse Destructors" was read by Mr. J. A. Robertson.

Institution of Electrical Engineers (Glasgow Students).—On March 19th, Mr. J. H. M'Minn, A.S.T.C., read a paper on electrically-driven centrifugals and accessories. The lecturer dealt with centrifugals used as sugar-curing machinery.

Liverpool and District Electrical Association.—A party of members of this Association paid a visit on Saturday, April 3rd, to the works of the Liverpool Electric Cable Co., Vauxhall Road, Liverpool. The visitors were received by Mr. W. S. Taylor, the engineer, and an inspection was first made of raw material and finished samples. The plant, which was in motion, is of modern design, electrically-driven, power being taken from the Liverpool Corporation. There are four main departments:—wire tinning and stranding, rubber covering, braiding and cotton covering, and testing. The copper wire is tinned by a special process, then wound on bobbins, and transferred to the stranding department,

where machines are installed capable of laying up cables up to a cross-section of 1·5 sq. in. In the insulating department there are numerous machines putting on the various coverings in one operation, viz, pure rubber separator, vulcanising rubber and tape. There are also a multitude of machines for cotton lapping, silk lapping, and braiding, and these machines attracted much interest owing to their high speed and perfect work. There is an ample testing department, where every coil has to pass a strict examination.

Institution of Civil Engineers (Students).—At the students' meeting on Friday, April 2nd, Mr. Wilfred Gurney read a paper entitled "Reinforced Concrete on Railways."

Junior Institution of Engineers.—At the last meeting of this Institution, the paper read was "The Use of Dielectrics, and the Principal Tests applied to Them," by Mr. Thomas German and Mr. Stanley M. Hills. After referring to the absence of information on what might be considered a very important subject, having regard to the fact that there was scarcely any electrical apparatus in which some insulation was not to be found, the authors proceeded with some general observations on dielectrics, and indicated what were the requirements of an efficient insulator. The qualities of porcelain, glass, air, and transformer and switch oils, were set forth and modes of testing described. The very important position held by varnishes in dielectric work was pointed out, and Warner's experiments were referred to. It was shown that deterioration was due to atmospheric and drying effects, and to the rapid alternations of stress. The slot method of testing for break-down voltage advocated by the authors was described, and the results shown. The paper concluded with the declaration that "all the present methods of coil insulation, such as rubber, varnished paper, &c., are unsatisfactory, the ideal insulation being one which can be applied in the form of putty or paint, and one which is a simple substance, and not a compound."

An interesting visit of this Institution recently took place, when, under the guidance of Mr. Philip Dawson, electrical adviser to the L.B. & S.C. Railway Co., the plant, &c., installed in connection with the electrification of the company's South London line was inspected. After seeing the features of interest at Battersea Park station, the members proceeded to Denmark Hill, where the switch cabin and the various recording instruments required by the Board of Trade were shown. An experimental train was shortly afterwards run into the station, and its construction, equipment and working were fully explained.

Iron and Steel Institute.—The annual meeting is to be held at Westminster (Institution of Civil Engineers) on Thursday and Friday, May 13th and 14th, at 10.30 a.m. Sir Hugh Bell will occupy the chair, as Sir W. T. Lewis, the new president, may not be able to be present. The annual dinner takes place at the Hotel Cecil on May 14th. Among the papers to be submitted to the meeting are the following:—

"On the Production of Iron Sheet and Tubes in One Operation," by S. Cowper-Coles.
"On the Preservation of Iron and Steel," by A. S. Cushman (Washington, U.S.A.).
"On the Manufacture of Peat Fuel," by Dr. M. Ekenberg, M.A. (London).
"On the Chemical Physics involved in the Decarburisation of Iron-Carbon Alloys," by W. H. Hatfield (Sheffield).
"On the Relation of the Solubility of Iron and Steel in Sulphuric Acid to its Heat Treatment," by Prof E. Heyn and O. Bauer (Gross-Lichterfelde).
"On High-Tension Steels," by P. Longmuir, B.Met. (Sheffield).
"On the Bristol Recording Pyrometer," by P. Longmuir, B.Met. (Sheffield), and T. Swinden (Sheffield).
"On a Heat-Treatment Study of Bessemer Steels," by Prof. A. McWilliam (Sheffield) and E. J. Barnes (Sheffield).
"On the Roechling-Rodenhauser Electric Furnace," by W. Rodenhauser (Saarbrücken).
"On the Value of Physical Tests in the Selection and Testing of Protective Coatings for Iron and Steel," by J. Cruickshank Smith (London).
"On further Experiments on the Ageing of Mild Steel," by C. E. Stromeyer (Manchester).
"On a Comparison of the Methods of Determining the Hardness of Iron and Steel," by Prof. T. Turner (Birmingham).
"On the Rusting of Iron, and Modern Methods for its Prevention," by Prof. W. H. Walker (Boston, U.S.A.).
A supplement to the Report on the Determination of Carbon and Phosphorus in Steel, presented by the Special Committee appointed in 1901, will be submitted by Mr. A. A. Blair (Philadelphia).

Faults on Tramway Motors.—Referring to Mr. Robinson's article on this subject, Mr. P. J. Pringle, borough electrical engineer and tramways manager, Burton-upon-Trent, writes to point out that the method suggested for tightening loose armature cores is a very expensive one; the method which Mr. Pringle put into use at Burton some 18 months ago, and which has proved quite successful, is to drive keys into the ventilating passages in the core, expanding the stampings so as to grip the shaft tightly. The keys are locked in place by a wrought-iron ring shrunk on the shaft, which also gives additional support to the end plate, and the oil-throwing ring previously shrunk on the shaft is now shrunk on to this ring. All his armatures have been treated in this way with satisfactory results; the cost is approximately 15s. per armature. An illustrated description of the method was published in the *Light Railway and Tramway Journal* in February last year.

Institution of Colliery and Mining Electrical Engineers.—We are informed by the secretary (*pro tem.*), Mr. J. Williams, 3, Moresby Parks, Whitehaven, that the inaugural meeting of this Institution will be held on April 24th at the Grand Hotel, Manchester, at 5 p.m. The chair will be taken by Mr. W. Maurice, M.I.M.E., M.I.E.E., general manager, Hucknall Colliery Co., Ltd., and the vice-chair by Mr. J. R. Salter, M.I.E.E., Atherton. The secretary will present a statement on the progress and purposes of the Institution. All interested in electrical and mining matters are cordially invited to attend.

Experiments on High Tensile Steel.—For some years many engineers have been of opinion that the use of steel of higher tenacity than the ordinary "mild" quality was justified, in view of the experience now possessed by makers of steel and of the economy that can be secured by the use of the stronger materials. Mild steel of about 30 tons tenacity has held the ground for many years, and yet when compared with harder steel it does not seem to be nearly so good a material for such an article as a high speed crankshaft. A crankshaft is exposed to such repeatedly alternating stresses for bending that it must be obvious that it is not desirable for it to deflect too seriously. Against deflection for a shaft, a stiff steel is more suited than a mild steel. But in such articles as a crank shaft it is probable that a good designer would make no change of section from ordinary practice. He would rather regard the entire strength and stiffness of the material as a means of increasing the freedom from failure of a member that is prone to failure. But in static work high tension steel can be used with safety in sections diminished by the amount of the increase of strength per unit section. Messrs. David Colville & Sons have recently had tested samples of their mild and high-tenacity steel, with a view to proving the superior strength and economy of the higher tenacity. We need not detail the manner of the tests; suffice it to say that, including the ingot weights, every precaution seems to have been taken to insure that all the comparative samples from each class of steel should be taken under circumstances, and tested in sizes, as nearly alike as it was possible to arrange. The net result of the tests is to prove that the mild and high tenacity steels have a strength which is in the ratio of 4:5. In other words, to carry a given load a piece of steel may have a section less by 20 per cent. than if it were of mild steel. This direct statement can, of course, only apply to parts in tension. For compressive pieces the question of buckling arises, and as regards the bending of a plate a reduction of 10 per cent. in thickness will represent a reduction of bearing capacity of about 20 per cent., or an increase of 25 per cent. in the allowable fibre stress means a 10 per cent. reduction in the thickness. Therefore it is desirable with increased compressive stresses to provide more lateral support, as by increasing the number of side stiffeners in a member of a structure so as, if possible, to take full advantage of the reduction in thickness on recantling which the higher stress should warrant. The tests generally are very uniform, and are in favour of the high tenacity steel. Curiously the value of the Young's modulus of elasticity is practically identical for the two steels, and every test shows a trifle over 30 million pounds for this value. The mild steel varies in tenacity from 26 to 29 tons approximately, and the high tension steel from 35 to 38 tons, the means being 27·4 and 35·7. The mean elastic limits were 8·35 and 10·55 respectively, as deduced from the ratio in bending to direct tenacity.

Cheap Cable Communication.—Writing in the *Westminster Review* for March, on "Communication by Cable," Mr. Charles Bright, F.R.S.E., reviews the subject from the standpoint of public utility. He points out that the trade routes followed by the cables are not good routes from a strategic point of view, and for this and other reasons, such as the necessity for consolidating the Empire, and assisting Imperial Trade, he advocates the laying of additional cables by the State, to complete the all-British chain of which the Pacific cable forms the first link. Mr. Bright, however, by no means favours the absorption of the existing cables by the State, pointing out that such a step would prompt other nations to abrogate their landing rights, and that the purchase price would be enormous. The merits of private enterprise are also recognised, and Mr. Henniker Heaton's extravagant demands for penny-a-word telegrams are duly stigmatised. The author advocates modifications in the tariff when the opportunity arises, and reduced rates for non-urgent messages, but deprecates criticisms of cable companies' tariffs based upon insufficient information.

In the *Fortnightly Review* for March Mr. Bright deals with the same subject, discussing the matter in the light of the initial and continuing risks involved in submarine telegraph enterprise, and the right of the shareholders in cable companies to substantial dividends, though he regards the very large reserve funds accumulated by the companies as of excessive proportions. Referring to Mr. Heaton's proposals, he points out their fallacious character; while recognising the desirability of a reduction of rates, he draws attention to the great difficulties in the way, and deprecates any attempt to acquire the companies' cables for the State. Rather, he would have an extension of the all-British system.

Bottom-Loop Lamps in the Navy.—With reference to the note on the above subject which appeared on page 580 of our issue of April 2nd, we are given to understand that the explosion there alluded to happened some five weeks or more ago, and was in no way electrically caused, being entirely due to a lighted candle being taken into bunker after bunker. For many years past it has been the practice of the Admiralty to use bayonet-holder lamps wherever possible, discontinuing the use of bottom-loop lamps save in exceptional circumstances.

Fatality.—An inquest was recently held concerning the death of G. H. Smart, an electrician employed at the works of Callender's Cable Co. at Erith. The evidence showed that deceased while climbing up the side of the roof of a motor shed, slipped and grasped an overhead 400-volt A.C. wire which was alive at the time and afterwards fell to the ground. Death was due to dislocation of the neck due to the fall. A verdict of "Accidental Death" was returned.

The Largest Electric Steel Works.—Only ten years ago P. Girod commenced making ferro-alloys with a 25-H.P. dynamo and one assistant. At the present time 9,000 H.P. are utilised for the same purpose during high-water season. More recently, however, Girod devised his well-known electric steel furnace and commenced the manufacture of steel. The results of this initial work have been entirely successful, and the Société Anonyme Electrometallurgique Procédés Paul Girod, with 5,000,000 fr. capital is now building at Ugine, in Savoy, a plant which may be regarded as the largest of its kind in existence. According to *E.M.I.* this new plant is expected to be in operation in March of this year, when water power will be available to the extent of 22,000 H.P. To give some idea of the magnitude and completeness of this undertaking some details will be of interest. The stock house is 58 ft. × 460 ft., and fully-equipped with travelling cranes and magnetic lifters. The furnace house is 70 ft. × 550 ft., and contains at present two 2-ton furnaces and two 10-ton furnaces. The latter take a charge of from 8 to 12 tons, using current at 60 volts and 32,000 amperes. The total output is 50 tons per day, but when the works are completed this will be increased by 200 tons. The transformer building is 33 ft. square, and receives current at 45,000 volts from St. Gervais, a distance of 24 miles. The various other departments are built on a scale similar to the above, and are remarkable for the completeness of their equipment. The plant is served by numerous branches of railway operated by overhead trolley as far as the works are concerned, but accessible to steam locomotives. The works are five miles from Geneva, 99 miles from Lyons, 230 miles from Marseilles, and 280 miles from Toulon (French naval station). They are reached from Paris *via* St. Pierre d'Albigny in the Mount Cenis Tunnel route, and it is understood that visitors will be cordially welcomed.

Rhymes of the Times.—

A ballad of wails
Appertaining to rails.

The attendant smiles as he scans the dials,
Volts and amps. are normal;
The rotaries rote and the motors mote
In manner decidedly formal.

The motorman hums as smoothly he runs,
Of worry and care independent;
He has nothing to fear, for the distant says "Clear,"
And smiles wreathe the face of attendant.

A swinging shoe on the track-rail flew,
Harmony ceased at the shock;
The attendant's remarks were as lurid as sparks,
And stopped the sub-station clock! J. W. C.

Yorkshire Tramway Managers. — The tramway managers of Yorkshire paid a visit to Hull this holiday time, arriving in the city by motor-car. They were met by Mr. J. W. McCombe, tramway manager at Hull, and Mrs. McCombe, and partook of luncheon at the Grosvener Hotel, after which they proceeded in special cars to Wilberforce House Museum, where the curator described the curiosities preserved in the birthplace of the emancipator of slaves. Afterwards the managers held a business meeting. The visitors included Messrs. E. Cross (Rotherham), A. Dagget (traffic superintendent, Leeds), H. England (secretary of the Yorkshire Managers' Association), A. R. Fearnley (Sheffield), E. A. Paris and P. H. Marco (Barnsley), McGibbon (Ossett), W. E. Nichol (Scarborough), C. J. Spencer (Bradford), and R. H. Wilkinson (Huddersfield).

Appointment Vacant. — Electric tester for H.M. Dockyard at Portsmouth (45s.). See our advertisement pages to-day.

The Tungsten Lamp and Revenue Reductions.—Some of the central station companies which have been backward in introducing the tungsten lamp to their customers have recently been undergoing some unpleasant experiences as regards the effect of the tungsten lamp on revenue. The situation in these cases seems to have been about as follows: The central station company has done nothing actively to make the consumer familiar with the tungsten lamp, the general theory being that it is best to let well enough alone so long as the consumer is satisfied with his existing inefficient installation. Sooner or later the local dealers and contractors have taken a hand in the game and have gone direct to some of the largest consumers offering an installation of tungsten lamps on the ground that it would make a great reduction in bills. Some large installations have been made, and the companies have lost in gross earnings because of the reduction of current effected by the tungsten lamp, and also in reputation because they did not call the attention of consumers to these lamps before they were introduced by the contractor. The wise course, and the one that has been pursued by the truly progressive companies, has been to call the attention of consumers to these lamps, explain their fragility, and tell each consumer that two to three times as much light can be obtained for the same energy consumption as with the present carbon-filament lamps. The majority of consumers, if dissatisfied enough with present bills to buy tungsten lamps, are willing to pay the same bills as formerly if they can obtain the promised increase in light. The result of this is to raise the standard of illumination to which customers are accustomed, and there is no opportunity for the consumer to feel or say later that he was not given the benefit of tungsten-lamp economy.—New York *Electrical World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—We are informed that MR. F. THOS. WOODWARD, of the Gillingham Electricity Department, who was recently appointed to the post of assistant clerk to the Shanghai municipality electricity undertaking, has decided to relinquish that appointment. The Gillingham Borough Council have appointed Mr. Woodward as commercial assistant to their electrical undertaking.

There has been 129 applications received for the post of resident electrical engineer at Tunbridge Wells, and seven of the applicants were selected to appear before the Committee on 14th inst.

MR. W. HARTLEY having resigned as mains superintendent to the Nelson Electricity Committee, MR. G. F. NAYLER has been appointed by the Council as chief assistant; MR. W. M. THOMSON, engineer-in-charge of the electricity works; and MR. W. G. COATES shift engineer.

On 14th inst. at the Swindon Corporation Electricity Works, MR. R. W. GRUBB, chief assistant engineer, was presented with a timepiece by the staff and employés on the eve of his approaching marriage. Mr. A. Dimmack, the chief engineer, made the presentation.

Tramway Officials.—At a meeting of the Bournemouth Town Council, held on April 6th, the Tramways and Parliamentary Committee recommended the appointment of MR. CHARLES WILLIAM HILL, chief assistant and electrical engineer to the Birmingham Corporation Tramways Department, as general manager of the Bournemouth Corporation Tramways. The recommendation of the Committee was made by a majority of seven to six. After the reading of correspondence between Mr. Baker, general manager of the Birmingham Tramways, Mr. Hill, and the town clerk, from which it appeared that Mr. Hill did not wish to place himself in direct opposition to the appointment to the office of Mr. Cecil Barber, the present traffic manager (who was next on the selected list out of 103 candidates), Alderman Druitt moved as an amendment that Mr. Cecil Barber's name should be substituted for that of Mr. Hill, on the ground that it had not been shown that the selected candidate had more experience than their present traffic manager, and that it was unfair he should be superseded unless it was clear they would be getting a better and more experienced man. Alderman Beale seconded the amendment, which gave rise to a long discussion, extending over several hours. In the result the amendment was defeated by 27 votes to 15. A further amendment to refer the matter back to the Committee for further consideration was also defeated by 22 votes to 19, and the recommendation of the Committee for the appointment of Mr. Hill was adopted.

MR. ANDREWS, late tramway traffic manager at Southend, who is leaving for Malta, has been presented by the staff with a diamond ring.

At the car depôt of the South Metropolitan Tramways Co. at Penge on Thursday last week, a Gladstone bag, dressing case and shaving set, were presented to INSPECTOR DORAN, who has secured an appointment with the Shanghai Electric Tramways Co. Mr. A. E. Wray, rolling stock superintendent, made the presentation on behalf of officers and men.

General.—On the 3rd inst. at Calcutta, the marriage of MR. G. R. DRUMMOND, engineer to the Bikanir Government, to Miss Olive Blanche Tarrant, youngest daughter of Mr. Thos. Tarrant, of Sydney, N.S.W., took place at St. Paul's Cathedral. A few days later Mr. and Mrs. Drummond proceeded up country to Agra—*en route* for Gwalior and Bikanir. Mr. Drummond, we understand, has agreed to stay on indefinitely at Bikanir on the understanding of being allowed to practise privately, and he is at present engaged as consulting engineer on the Gwalior electric scheme. This is at present continuous-current three-wire, but it will be gradually changed over to three-phase four-wire. Mr. Drummond was sent for in June last year to report on the Baroda electric scheme, by His Highness The Gaekwar, but up to date no re-organisation has been commenced.

The Government has made a grant from the Royal Bounty Fund to MR. H. W. COX, who, as recently stated, has sustained serious and permanent injuries in connection with X-ray research work.

MR. J. S. BEDDOE, of Pembroke, has been appointed second assistant electrical engineer to the Admiralty; and MR. A. E. FRANKLING to a similar position at Portsmouth Naval Establishment.

MR. F. C. WILLIAMS, late engineer-in-charge at the central power station of the Tredegar Iron and Coal Co., Tredegar, sailed on 10th inst. per R.M.S. *Norman* for Natal, to take up the post of electrical engineer to the Elandslaagte Coal Mines Co., Natal.

Obituary.—MR. JOHN WILSON, manager of Leith Corporation electric tramways, died last week.

The death occurred on Sunday last of MR. EDWARD NETTLEFOLD, who was at one time a managing director of the well-known screw manufacturing firm of Nettlefolds; after the amalgamation of that business with Guest, Keen & Co., he held a seat on the board of the combined company.

NEW COMPANIES REGISTERED.

Mining Engineering Co., Ltd. (102,215).—This company was registered on March 26th, with a capital of £8,000 in £1 shares, to carry on the business of manufacturers of mining machinery, implements and tools, rock drills, air compressing machinery, steam engines, electrical machines, cables, &c., to acquire and work certain patents for inventions, and to adopt an agreement with the Armaturen-und Maschinenfabrik "Westfalia" Aktien-Gesellschaft, of Gelsenkerchen. The subscribers (with one share each) are:—G. B. Walker, Tankersley Grange, near Barnsley, mining engineer; J. Galloway, Foster's Buildings, High Street, Sheffield, mining engineer. Private company. The number of directors is not to be less than three or more than five; the first are G. B. Walker (chairman), I. Hodges and C. Christiansen. The said C. Christiansen is nominated by the above-mentioned company; qualification (except such nominee), £250; remuneration of chairman, 100 guineas per annum; of other directors, 70 guineas each per annum; the chairman is to receive 10 guineas for each board meeting attended by him. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

"Le Radiant," Ltd. (102,296).—This company was registered on March 30th, with a capital of 25,000 in £1 shares (7,500 participating pref.), to acquire from C. Fonteyn a contract for selling the apparatus known as "Le Radiant," and the patent rights for the United Kingdom in an electric oven, to adopt an agreement with the said vendor, and to carry on the business of electricians, mechanical engineers, producers and workers of and dealers in electricity, &c. The subscribers (with one share each) are:—C. Fonteyn, 76, Newman Street, W., importer of electrical apparatus; A. Slater, 34-5, High Holborn, W.C., solicitor; C. F. Rogers, 76, Newman Street, Oxford Street, W., managing clerk; G. Chalcroft, 127, Stapleton Hall Road, Stroud Green, N., solicitor; W. G. Hall, 65, London Wall, E.C., incorporated accountant; T. H. Hall, 76, Newman Street, Oxford Street, W., glass merchant; R. Elliott, 133, Hertford Road, Dalston, N.E., clerk. Minimum cash subscription, £100; the number of directors is not to be less than two or more than five; the first are C. Fonteyn and A. Slater; remuneration, £100 each per annum and 5 per cent. of the net profits, divisible. Registered office, 34-5, High Holborn, W.C.

Power Engineers, Ltd. (102,302).—This company was registered on March 30th, with a capital of £2,000 in £1 shares, to carry on the business of electrical, mechanical and civil engineers, manufacturers of and dealers in electrical and other machinery and appliances, &c. The subscribers with 100 shares each) are:—W. B. Esson, Bank Buildings, Kingsway, W.C., civil engineer; R. B. Matthews, 196, Eaton Crescent, Swansea, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. B. Esson and R. B. Matthews; qualification, 100 shares. Registered offices, Bank Buildings, Kingsway, W.C.

Morris & Lister, Ltd. (102,268).—This company was registered on March 29th, with a capital of £10,000 in £1 shares (5,000 preference), to acquire the business carried on at Coventry, to adopt an agreement with D. K. Morris and G. A. Lister, and to carry on the business of manufacturers of and dealers in apparatus, instruments and fittings used in connection with the generation, distribution, supply and employment of electricity, electrical engineers, electricians, &c. The subscribers (with one share each) are:—D. K. Morris, 47, Cumberland Mansions, Seymour Place, W., electrical engineer; G. A. Lister, Fernlea, Stanmore Road, Edgbaston, Birmingham, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are D. K. Morris, G. A. Lister, and R. K. Morcom; remuneration as fixed by the company. Registered office, Carlton Works, Lockhurst Lane, Coventry.

Mersea Motor and Electric Co, Ltd. (102,298).—This company was registered on March 30th, with a capital of £2,000 in £1 shares, to establish and maintain communication by steam, spirit or electrical power motors, lorries, tramways, railways or boats between the Island of Mersea and London, Colchester, Brightlingsea, Tollesbury or elsewhere. The subscribers (with one share each) are:—E. E. Meade, 19, Norbury Gardens, Norbury, Surrey, accountant; J. J. Edwards, Mount Pleasant Lane, Upper Clapton, N.E., gentleman; W. H. Vincent, Martin's Cottages, High Street, Sevenoaks, stationer; J. H. Gardner, West Mersea, Essex, merchant; A. G. Harford, 58, Raleigh Road, Hornsey, N., traveller; G. H. Taylor, 16, Rutland Park Mansions, Walm Lane, Cricklewood, N.W., warehouseman; H. A. Edgar, 20, Bucklersbury, E.C., solicitor. Private company. The number of directors is not to be less than two or more than seven; the first are E. E. Meade, J. J. Edwards, and J. H. Gardner. The directors may increase the capital to £10,000. Registered office, 90-91, Queen Street, E.C.

Globe Electric Co., Ltd. (102,289).—This company was registered on March 30th, with a capital of £3,000 in £1 shares, to acquire the goodwill of the Santoni Arc Lamp and Engineering Co., Ltd., formerly carried on at 11, Farringdon Avenue, E.C., to adopt an agreement with S. J. Atkinson, and to carry on the business of electrical and general engineers, contractors, manufacturers of electrical and mechanical appliances for lighting, power and traction, &c. The subscribers (with one share each) are:—S. J. Atkinson, 18, Palace Road, Streatham Hill, S.W., electrical engineer; E. C. Mahany, 7, Horsford Road, Brixton Hill, S.W., clerk. Private company. The number of directors is not to be less than two or more than five; the first are S. J. Atkinson and D. L. Santoni (joint managing directors); qualification, £250; remuneration (except managing director) £1 1s. each per meeting attended. Registered by J. T. Goddard, 5 and 6, Clement's Inn, E.C.

Polkey Automobile Electric Lighting Syndicate, Ltd. (102,335).—This company was registered on March 31st, with a capital of £2,000 in £1 shares, to adopt an agreement with J. Polkey, and to carry on the business indicated by the title. The subscribers are:—J. Polkey, 126, Pitsford Street, Birmingham, lamp manufacturer, 25 shares; G. A. Polkey, 126, Pitsford Street, Birmingham, lamp manufacturer, 25 shares; A. R. Lancaster, Glascote House, Tamworth, chartered accountant, 50 shares. Private company. The number of directors is not to be less than two or more than five; the first are J. Polkey and A. R. Lancaster; qualification, 25 shares. Registered office, 126, Pitsford Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tyneside Electrical Development Co., Ltd. (90,884).—This company's annual r turn was filed on March 16th, when the entire capital of £100,000 in £1,000 shares had been taken up. £100 per share has been called up, resulting in the receipt of £10,000. Mortgages and charges: Nil.

Waste Heat and Gas Electrical Generating Stations, Ltd. (91,788).—This company's annual return was filed on March 11th, when the entire capital of £150,000 in £1 shares had been taken up. £1 per share has been called up on 68,402, 15s. per share on 16,598, and 5s. per share on 65,000 shares, resulting in the receipt of £97,100 10s. Mortgages and charges: Nil.

St. James' and Pall Mall Electric Light Co., Ltd. (26,015).—This company's annual return was filed on March 13th, when the entire capital of £300,000 in 40,000 ordinary and 20,000 preference shares of £5 each had been taken up. £298,250 has been received, leaving £1,750 in arrears. Mortgages and charges: £150,000 3½ per cent. debenture stock and £200,000 4 per cent. guaranteed stock of the Central Electric Supply Co., Ltd., being half the total loan.

London Telegraph Training College, Ltd. (92,661).—Particulars of £400 debentures created February 27th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £300. Property charged: The company's undertaking an l property, present and future, including uncalled capital. No trustees.

Torquay Tramways Co., Ltd. (96,012).—Issue on March 11th of £60,000 debentures, being the whole of a series created November 26th, 1908, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: L. B. Schlesinger and Sir Nathaniel Nathan.

Northampton Electric Light and Power Co., Ltd. (28,640).—Issue on March 25th of £1,200 debentures, part of series created June 3rd, 1896, to secure not more than two-thirds of the paid-up share capital, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Buenos Aires Port and City Tramways, Ltd. (85 427).—Particulars of £250,000 first mortgage debenture stock created by resolutions of August 1st, 1905, and February 10th, 1909, and secured by trust deeds dated October 30th, 1905, and March 20th, 1909 (the latter now registered), filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £50,000. Property charged: The company's property, present and future, including uncalled capital and concession for construction of electric tramways at Buenos Aires. Trustees: C. W. H. Lowther and J. G. B. Stone.

Morley Electrical Engineering Co., Ltd. (52,358).—This company's annual return was filed on February 16th, when 1,524 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £504 has been received, and £1,020 is considered as paid. Mortgages and charges: £3,000.

Cambridge Electric Tramways Syndicate, Ltd. (79,744).—This company's annual return was filed on March 2nd, when 107 shares had been taken up out of a nominal capital of £5,000 in £10 shares. £9 0s. 4½d. per share has been called up on 90, £10 per share on 10, and nothing on 7 shares, resulting in the receipt of £911 12s. 1d. Mortgages and charges: Nil.

J. Defries & Sons, Ltd. (39,949).—Charge on a book debt due from the Midland Railway Co., dated March 13th, 1909, to secure £174 17s. 1d. Holders: Messrs. Gedge & Feeny, 60, Queen Victoria Street, E.C.

Gratze, Ltd. (101,857).—Particulars of £2,500 debentures, created March 19th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Chipping Norton and District Electric Light and Power Co., Ltd. (98,562).—Particulars of £8,000 debentures, created March 19th and secured by trust deed dated March 22nd, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Above-mentioned trust deed also registered. Property charged: Certain land at Chipping Norton, with buildings, plant and machinery thereon, and the company's undertaking and property, present and future, including uncalled capital. Trustees: O. Walker and A. E. Locke.

C. Shardlow & Co., Ltd. (101,383).—Particulars of £650 debentures created March 24th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electric Supply Corporation, Ltd. (52,036).—Trust-deed dated July 18th, 1904, was stamped on April 1st, 1909, to cover a further £10,000 (in addition to £100,000 already registered). Property charged: The company's undertaking and property, present and future, including uncalled capital. Holders: C. F. Tufnell, Kenley, Surrey, and W. B. M. Bird, 58, Cadogan Place, S.W.

Guildford Electricity Supply Co., Ltd. (36,725).—Issue on March 31st of £1,100 debentures, part of a series of which have already been filed.

CITY NOTES.

South Wales Electrical Power Distribution Co.

Mr. W. Gascoyne Dalziel presided at the annual meeting held at Cardiff on Tuesday last week. In moving the adoption of the report (see Electrical Review, March 26th, page 525), he said that he was dealing with a concern which, immediately prior to the appointment of the present board of directors some 18 months ago, was in imminent danger of going into the hands of a receiver. The directors were now reporting upon the progress made during 1908, with the arrangements come to between the debenture-holders on the one hand, and certain of their principal consumers, who had formed the Treforest Electrical Consumers' Co., Ltd., on the other hand. The amount of the debenture issue was £200,000, and the debenture-holders found that nothing like this sum could be realised if they sold the property; nor was that position altered to-day. The advantages of the new Act of Parliament recently obtained by the company were described by the chairman. He next said that virtually, the whole concern was in the hands of the debenture-holders, who, however, voluntarily entered into the agreement with the Treforest Electrical Consumers' Co., Ltd., with the object of giving that company an opportunity of carrying on the concern. The inducement to the Treforest Co. to enter into this arrangement was that by so doing they could secure the continuity of the supply to the respective collieries and works of their members. The Treforest Co. had thus, under this agreement, taken over the working and maintenance of the Treforest generating station and of the mains and sub-stations within the Treforest area. They had also spent upon that generating station the sum of about £30,000 in putting in up-to-date steam turbine plant and certain accessories

required for the safe and economical generation of electricity and other work in connection with the supply. Against the capital so expended this company had allotted to the Treforest Co. prior lien debentures of equal value, forming a first charge upon the whole assets of the company. This capital expenditure had already resulted in very satisfactory economies in working, although the full benefit had not yet been realised. In spite of the fact that several large collieries had ceased taking supplies from the company, the horse-power at present connected to the Treforest mains was over 6,700, while when all the additions promised by the existing consumers were completed, the total H.P. connected in the Treforest area would be at least 9,000. The output sold in the Treforest area, taking the average of the months of January and February last, was at the rate of over 8½ million units per annum. This output would, of course, be greatly increased when the additional horse-power was connected, and there was every prospect of the cost of working being reduced so as to leave a margin upon the revenue produced by the Merz scale of charge. The monthly extra amount required to meet all expenses was, during some of the months of last summer, considerably over 100 per cent. above the revenue produced by the Merz scale, but it had already fallen to below 30 per cent. The progress thus made should be encouraging to the existing consumers, and should induce others to join. It was originally intended that a similar consumers' company should be formed for the Cwmbran area, but as this scheme fell through the Treforest Co. decided to take over the working of the Cwmbran area also. They were constructing a connecting main, connecting the Cwmbran area with the Treforest area. This would make it possible to work these two areas from the one generating station at Treforest. By so doing an addition of about 550 H.P. would at once be connected to the Treforest generating station. This line was rapidly approaching completion, and probably within a month or two the supply for the Cwmbran area would be given from the Treforest generating station. The Cwmbran generating station would then be shut down, but retained as a reserve or standby in case of emergency. Two of the existing consumers in the Cwmbran area had subscribed capital to, and had joined, the Treforest Electrical Consumers' Co., Ltd., in anticipation of the completion of these arrangements. An entirely new consumer had now signed an agreement to take all the electricity required for five years from the company, and was busily engaged making arrangements to drive machinery to the extent of 500 H.P. to start with, having further developments in view. The route followed by the main was likely to prove a useful one, as it brought the supply within a reasonable distance of several collieries, some of them being new sinkings. It should be a comparatively easy matter to connect up several of these collieries by running overhead lines. The Mountain Ash Urban District Council were about to take a supply of electricity from the company's mains for lighting Ynysybwl. A satisfactory agreement had also been made with the Llandaff and Dinas Powis Rural District Council for a supply in bulk for lighting Whitchurch. The revenue account necessarily dealt only with Cwmbran, Bridgend, and Neath, all of which generating stations were carried on during last year by the principal consumers in the respective areas, who paid to the company sufficient money to defray the cost of working them. It must be borne in mind that even the debenture interest on £200,000 had been deferred by Act of Parliament, and it was very difficult to see how there could be any reasonable chance of the preference and ordinary shareholders receiving any dividend for some time to come. There had, of course, been nothing in the nature of a reconstruction, which could only be carried out by special act of Parliament. The accounts, therefore, must continue to show the assets of the company at the price paid for them, though, of course, this did not at all represent their present value. While it was impossible to put forward anything at all hopeful in the way of a promise of dividend, it would, however, be seen that, in addition to saving the concern from destruction, a great deal had been accomplished in clearing away obstacles. He thought he might briefly summarise the present position by saying that, so far as the removal of these obstacles could assist the Treforest Co. in bringing the concern to such a condition as to enable the payment of debenture interest to be made out of the earnings of the Treforest generating station, everything possible had been done. When the Treforest Co. found themselves in that position, it might be possible for the South Wales Power Co. to purchase the prior lien debenture bonds held by the Treforest Co. and to resume control of the undertaking. At that time it might be desirable to evolve some scheme of reconstruction to be sanctioned by Parliament.

Mr. T. O. Callender seconded, and the motion was carried.

The Chairman paid a high tribute to Mr. W. A. Chamen (manager), Mr. G. P. Tutcher (secretary), and Mr. Spencer (solicitor) for the services they had rendered to the company.

Cuba Submarine Telegraph Co., Ltd.

The meeting of this company was held on Wednesday at 58, Old Broad Street, E.C., Mr. George Keith presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, April 9th, page 605), after referring to the unavoidable absence of Mr. C. W. Parish, the chairman of the company, through illness, said that as the shareholders were aware, the prosperity of the company depended on the state of the sugar trade. Last June, when Mr. Parish addressed them, he told them how seriously they had been affected by the failure of the sugar crop. The latter half of the year, from July to December, was always occupied in the preparation for the sugar crop, and there were less signs of activity. It was, therefore, not surprising that as the first part of the year, which was generally the best for the company, had not been very good, the latter half also showed a decline. They would see from the report that they received £12,909, as against £16,158 from January to June. That figure also compared badly with the corresponding period last year, when they received £15,715—or nearly £3,000 more than the six months with which they were dealing. The American occupation of the island came to an end last January, and it was to be hoped that they would now have a period of peace and prosperity. Their cables had worked well, and they had had no difficulty in dealing with the traffic with which they had been entrusted. Turning to the revenue account, they would see that their receipts were £12,909, which, with the £1,942 received from interests and investments, made altogether £14,847. The expenses were £6,025, compared with £8,832. They had placed £1,000 to reserve, and paid the dividends on the preference shares, which had absorbed £3,000, and they proposed to pay a dividend of 6 per cent. on the ordinary shares, thus maintaining the same rate of dividend that they had paid for the last three years. The amount put to reserve was not so large as in previous years, but the directors recognised that the £111,000, which they had as a reserve, was a good one. The details of the expenses were very similar to those of the corresponding half of 1907. The capital expenditure showed an increase of £2,400, which was accounted for by the fact that they had acquired the freehold of some property at Santiago.

Mr. R. K. Gray seconded the motion, and the report was adopted.

Canadian General Electric Co., Ltd.—The report for 1908 says that the year had been one of world-wide industrial depression, and, in view of the prevailing conditions of trade, it was gratifying to be able to submit so satisfactory a financial statement. The surplus account showed a profit somewhat in excess of 1907, and this result was obtained on a decreased output. Owing, however, to a policy of rigid economy, operating expenses were proportionately reduced, and, after ample provision for depreciation and the payment of interest and dividends, a substantial sum has been carried forward at the credit of profit and loss account, as a result of the year's operations. Notwithstanding the continued industrial depression, the company was fortunate in securing several important contracts, which, added to current business, will keep the company fairly busy during the year. During the past three months more orders have been secured than during the previous six months, and as present indications point to a material improvement in trade conditions the future is looked forward to with more confidence than at any time during the preceding year. The profit for the year (before providing for depreciation and interest on borrowed capital) is $753,088. Depreciation of buildings, machinery, patterns, &c., and interest absorb $242,720 and dividends paid (7 per cent.) amount to $439,042, leaving $71,325, which, with the undivided profits as at December 31st, 1907, makes a balance at credit of profit and loss account of $145,231, in addition to which the reserve fund amounts to $1,66?,532.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Mexico Tramways Co.—Scrip, fully paid, or £1,250,000 6 per cent. 50-year mortgage bonds.

Montreal Water and Power Co.—£75,000 4½ per cent. prior lien gold bonds of £100 each (registered).

And to allow the following securities to be quoted in the Official List:—

American Telephone and Telegraph Co.—$50,000,000 additional 4 per cent. convertible bonds, 1936, Nos. 100,001 to 150,000, for $1,000 each.

County of London Electric Supply Co., Ltd.—Further issue of 1,240 6 per cent. cumulative preference shares of £10 each, fully paid.

Montreal Water and Power Co.—£357,100 4½ per cent. prior lien gold bonds (registered) in lieu of the same amount of 4 per cent. bonds now quoted.

P.P.K. (Ceylon) Rubber Estates, Ltd.—65,000 shares of £1 each, fully paid, Nos. 1 to 65,000.

The Committee has appointed a special settling day as under:—

Wednesday, April 21st.—South London Electric Supply Corporation, Ltd.—£100,000 5 per cent. first mortgage debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

County of London Electric Supply Co., Ltd.—Further issue of 1,592 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 182,169 to 183,760.

South London Electric Supply Corporation, Ltd.—£100,000 5 per cent. first mortgage debenture stock.

Adelaide Electric Supply Co., Ltd.—Further issue of 19,225 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 10,001 to 28,225 and 29,001 to 30,000.

British Aluminium Co., Ltd.—On 7th inst., at Winchester House, Mr. G. A. Touche presided over the adjourned meeting of the first mortgage debenture stockholders, and a resolution was passed varying the terms of the trust deed so as to enable authority to be given to the Loch Leven Water and Electric Power Co. to raise debentures of £240,000 upon its property. The chairman said that the large works at Kinlochleven were now practically completed.

Germany. — The Bergmann Electricitätswerke Gesellschaft, of Berlin, reports a gross profit of £224,199 for the last financial year. A dividend of 18 per cent. is being declared, the same as for the preceding 12 months.

Cork Electric Tramways and Lighting Co., Ltd.

The directors report that for the year 1908 the receipts were £52,155, and the expenses £33,351, leaving £18,804, plus £734 brought forward, and less interest on debentures £4,600, making £14,938. Of this account £6,163 was paid on July 1st and January 1st for the half-yearly dividend on the 5 per cent. cumulative preference shares, £2,500 is added to reserve for depreciation, £2,109 has been written off, as per revenue account, and the directors recommend a 3 per cent. dividend on the ordinary shares, absorbing £3,450, carrying £716 to revenue new account. The lighting and power business continues to show satisfactory progress, although the revenue owing to the more general introduction of metallic-filament lamps has not increased in the same proportion as the additional connections. The directors, however, are of the opinion that although the reduction in the cost to consumers of electricity owing to the use of these lamps has curtailed the revenue during the past year to a substantial extent, this will, in course of time, be more than compensated for by the advent of new customers and will be of considerable advantage to the company. Owing to continued trade depression the traffic receipts are disappointing, being £186 less than in the previous year. Capital expenditure during the year has been mainly expended on house services and cables. No shares or debentures have been issued during the year.

	Traction.					Lighting and power.		
	Miles open.	Passengers carried.	Aver. fare.	Car-mileage.	No. of cars.	No. of customers.	8 c.p. (equiv.). Applied for.	8 c.p. (equiv.). Connected.
906 ..	9·89	5,966,364	1·00d.	891,998	35	1,679	100,543	98,852
907 ..	9·89	5,780,625	1·00d.	895,914	35	1,850	114,519	112,495
908 ..	9·89	5,787,478	1·00d.	896,945	35	1,987	125,516	121,906

Willans & Robinson, Ltd.

The thirtieth half-yearly meeting was held on Tuesday, April 6th, at the Cannon Street Hotel, Mr. James C. Peache, the managing director, presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, April 2nd, page 567), explained that the reason he was in the chair was because, prompted by medical advice, Mr. Mark Robinson had conditionally placed his resignation as chairman in the hands of himself (Mr. Peache) and his co-director, Mr. Anderson. In the natural course of things they would have asked Mr. Robinson to postpone the question of retirement and take leave of absence, in the hope that with rest and change his health would be restored—a course that he was sure would willingly have been agreed to by the shareholders. Mr. Robinson, however, told them that he had given this alternative his full consideration, but he felt that if he were to retain his office it would be impossible for him, in his present nervous state, to free himself from the sense of responsibility and anxiety attaching to that office, and that, therefore, provided the company would grant some substantial provision for those dependent on him, he wished to be allowed to resign at once instead of serving for the remaining two years to which his election in April last entitled him. He (Mr. Peache) was sure the shareholders would share in the distress they felt at seeing a man of Mr. Robinson's courage and energy brought to his knees. His colleagues were very conscious of the loss they would suffer from being in future without the support and guidance that his great experience and readiness of resource enabled him to supply. The shareholders, too, would readily understand that with this resignation coming so suddenly on them, the board had not yet had time to adjust themselves to the altered circumstances. Mr. Robinson had drafted and edited the report, and until a day or two before it was issued he had been actively engaged in the negotiations that led up to Mr. Leslie Robertson's nomination as a director of the company. He had also carried out the difficult transactions in connection with the debenture trust which only so lately as last week resulted in a settlement that both improved the security of the debenture-holders, and at the same time greatly strengthened the financial position of the company. In formulating the resolutions which he now asked them to approve, they had had Mr. Robinson's co-operation, so that those resolutions carried the unanimous recommendation of the three directors who had been responsible during the last year for the conduct of the company's business. For further changes or additions to the board which in the future might prove to be desirable, he would beg them to give the board time to settle down with their new colleague, Mr. Robertson (for he hoped they would approve his nomination at that meeting), so that when next they met them they might be in a position to put such carefully-considered proposals before them as might appear desirable for assuring the permanent consolidation and stability of the board. Meanwhile, they might be satisfied that the interests of the company would be efficiently looked after by them. For the last year, as managing director, he (the speaker) had had charge of the whole of the executive work of the company, and, although he should miss Mr. Robinson's advice and help in many ways, there was no very great amount of new burden placed on him. They had at the present time a most efficient and capable staff to carry out the actual work of the company; and in Mr. Anderson, and, he hoped, Mr. Robertson, they would have two sound business men who would, he was sure, keep an efficient check on the managing director, as well as assist him in keeping an efficient check on the books and staff. Turning to the report and accounts, as regarded the Rugby business they might congratulate themselves that, notwithstanding the unsatisfactory state of trade that had prevailed during the last year or so, the results for the half-year were good. The total quantity of work turned out during the half-year at Rugby probably exceeded anything that had before been achieved. Even in values invoiced (and these had been on the low scale of prices now ruling) the amount for the half-year very closely approached the best that was done in the most prosperous period of the company's history. An examination of the figures that went to make up the Rugby profits disclosed some most satisfactory items. On Diesel engine account for the half-year they now made a profit; it was not a large one, but it was the beginning of the revenue that they had anticipated from this source. On condensing plant made during the past half-year they had earned substantial profits; this was another of the new branches of manufacture that within the last year or two they had taken up in the endeavour to keep their shops busy. In no instance had the depression in trade been so severely felt as in the steam turbine business, and, in addition, they had recently had to meet a very severe competition from rivals who were exploiting new types of turbine, of which the designs, and in many cases the turbines themselves, were imported from the Continent. It was entirely due to the great success that this company had made of the turbine business that such profits had been realised as had enabled them to drag the business out of the desperate straits to which it was reduced five years ago. Owing to the slackening in demand, and to the present severe competition, their profits on steam turbines had seriously fallen off. That that state of things was temporary the directors fully believed. During the last year they had installed a magnificent turbine of some 10,000 h.p. at Manchester, and two almost equally large turbines in the L.C.C. station at Greenwich. Besides that, they had recently installed important units at Leeds and Sheffield. All these were pioneer transactions—that was, in obtaining those orders they had captured new stations. They were firmly convinced that the success of these great units, and they were all of them giving the greatest satisfaction, would redound to their credit in the future, and when trade again took a turn for the better, they would reap their full share of the turbine business, notwithstanding the competition of their Continental rivals and their followers in this country. In the meantime, however, there was the more need for them to develop new branches of manufactures at Rugby. He had already spoken of two such new branches—condensing plant and Diesel engines—these were already beginning to yield them profits. They had others also well advanced, and that would shortly, they trusted, reach the profit-bearing stage. Of Queen's Ferry they had little to report. A great part of the plant and the stocks were sold off at the beginning of November last. By a resolution passed at the meeting of the debenture-holders on Tuesday last, the proceeds of the sale of fixed plant, amounting to £9,313, was rendered available for purchase of new plant for the Rugby works as required. Meanwhile that money was held by the debenture stock trustees. The proceeds of the sale of stocks, together with the large amount of working capital released by the closing of the Queen's Ferry works, was now available for the general purposes of the business. The works themselves were standing empty awaiting a purchaser; the annual cost to the company while they were so standing was small. They must exercise patience. Although they had so far obtained no actual purchaser, they had been on two or three occasions very close to that end, and they might reasonably hope before long to actually succeed; for Queen's Ferry was a magnificent works and should offer great attractions to any concern seeking new quarters. Turning to the accounts, the Queen's Ferry works stood at £89,943 in the balance-sheet. That was a doubtful figure, but it was a matter of no great importance. What was of the greatest importance, and what they had been devoting their energies to, was the building up of reserves against that item, and of otherwise providing for the liquidation, without injury to the business, of any loss which might arise on its sale. The item of patents—£7,281—showed an increase over the £5,897 at which it stood last half-year. They had written off the usual allowance for depreciation, but the additions during the half-year had more than balanced this. Diesel engine suspense account, £5,104, was a similar account. It was kept distinct from the former, because a year ago the directors pledged themselves to write off this amount in five years, and a corresponding fraction was, in pursuance, being written off each half-year. Cash at bank and in hand on December 31st stood at £59,697, and this did not include the money realised on the sale of stocks at Queen's Ferry. That money was not paid over by the end of the year, but was included in the items of debtors. To-day the bank balance stood at £85,141, a satisfactory indication of the present stability of their position. The profit and loss account was necessarily a little difficult to understand. It was necessary, as a matter of correct accounts to give a profit and loss account for Queen's Ferry for the short time at the commencement of the half-year that the Queen's Ferry works were kept working as a trading concern, and most of the various debit items were amounts proportionate to that short period, the balance of these debit items being set against Rugby. In future, the Rugby profit and loss account would bear the whole of such charges as debenture interest, directors' salaries, and so on; charges which hitherto had been allocated partly against Rugby and partly against Queen's Ferry. The net result for Queen's Ferry—viz., a loss of £825—must be regarded as a satisfactory result, for these few weeks of working at Queen's Ferry had had to bear the cost of closing a number of orders on which a final loss was inevitable. That the total loss was so small as £825 was due to the fact that ample provision had been made for depreciation of stocks and work in progress. In the Rugby profit and loss account they had written off £9,624 against depreciation. This was a considerably larger amount than was written off last half-year. In addition to the usual allowance for depreciation, they had written off an extra £1,000 on account of sundry items of plant, which, in their opinion, stood at too high a value in the books.

He was a little diffident in making anything in the nature of a definite forecast of the immediate future of the business. Prophecy was always dangerous, and the present serious and long-continued depression in trade made one the more cautious about speaking too confidently about future prosperity. A month ago they considered it necessary to put the works on short time on account of scarcity of orders, and they were not yet in a position to resume full time. This state of things could not fail to adversely affect the results of the current half-year's working, but there were signs of more work in the immediate future, and of one thing they were confident, and that was that their staff and shops at Rugby were in a more efficient and capable condition than at any previous time, and that with an improvement in the state of trade, which they might reasonably expect before long, they were in a favourable position for obtaining a sufficient share of orders, and of being able to turn the work out cheaply and quickly when obtained. At the last half-yearly meeting they warned the shareholders that unless a decided improvement in trade took place a dividend on the ordinary shares must not be depended on. After careful consideration, the directors did not feel that they would be justified in recommending a dividend on the ordinary shares for this half-year. It was a policy of caution; but until the outlook was clearer than was the case at the present moment, the directors felt that it was their duty to husband the resources of the company.

Mr. Palmer seconded the motion.

The Chairman, in reply to shareholders' questions, said that the directors only wished that the £189,000 standing as "debtors' balances" was even more. He did not receive the same remuneration as Mr. Robinson did; he only received £2,000. It was their practice to charge travelling expenses to specific jobs where possible. The company used to have a fire insurance fund under a debenture trust deed, and it was proposed to put aside a certain amount of money each year, so as to reach £25,000, accumulating to £50,000. The fund had now reached £30,000, but the debenture-holders had agreed to release that money provided the company made an insurance in the ordinary way.

The report was adopted.

Mr. Leslie S. Robertson was elected as a director, and Mr. G. W. Anderson was re-elected.

A resolution was carried accepting the resignation of Mr. Mark Robinson, and it was agreed to give him one year's salary.

Metropolitan Electric Tramways, Ltd.

The ordinary general meeting of this company was held on Tuesday last week at the Electrical Federation Offices, Kingsway, W.C., Sir Ernest Spencer presiding.

In moving the adoption of the report (see Electrical Review, April 9th, page 606), the Chairman said that they would see that the reconstruction and renewals fund showed that they had the substantial sum of £41,936. They had decided, in conjunction with the Middlesex County Council, to invest that money in well-approved securities, so that it would be available when required. Turning to the accounts they would see that they had placed £16,566 to that fund, which was £6,000 in excess of the previous year. That was not the only thing which they had done in connection with the future, for they had placed to the maintenance and repair fund £22,632, so they had provided not only for the present but for the future to keep the property in a good and efficient state of repair. The expenditure amounted to £94,762, which had been caused by the equipment of new lines, by expenditure on rolling stock, and by a further payment in connection with street widenings. Under sundry creditors it would be seen that they owed the Middlesex County Council £36,716, but since the close of the financial year that had been paid off. Sundry debtors showed that the North Metropolitan Electric Supply Co. owed them £17,500, which was their dividend on the shares which they held in that concern, and £28,580 which was temporary loans. They would notice that £4,400 had been paid in the reduction of debenture stock. They were now having to provide a sinking fund for that purpose, and with the consent of the trustees of that fund, the money paid in had been used wisely in cancelling debenture stock. The amount of traffic receipts showed a satisfactory increase—the figure standing at £55,812, and whilst, of course, some of it came from the new lines, it was largely received in connection with the expansion of the old lines. Although they had no reason to have any fear in regard to the new lines, it was very satisfactory to think that the old lines were expanding in so satisfactory a manner. The total revenue of the year was £331,835 as against £277,597. It might appear a little disappointing that they had carried £3,000 less to balance, but there were perfectly good reasons for this. In the first place, they had paid to the Middlesex County Council £11,000 more than in the previous year—£45,600 as against £34,000. They had also paid the County Council a full year's increase on the new lines on which naturally they had not received the full benefit at present. In addition to that their ordinary expenses had been greater—but not greater than was warranted considering the increase in their traffic and car-mileage. The item of insurance was larger by £2,200. As had been explained before, they had a system of insurance with the federated companies, against third-party risks. At first they had benefited very considerably from the arrangement, but they had had to rearrange the scheme, and they had paid £2,200 more for insurance this year. They would see that an item of £200,000 stood in the balance sheet for reserved debenture stock. That arose in pursuance of the policy which was foreshadowed at the last meeting, and was caused by the fact that under their agreement with the Middlesex County Council they had to electrically equip the roads as they constructed them, and they now had 10 or 11 miles which it would be necessary to operate upon. The time did not seem opportune for raising ordinary capital, and for the time they had exhausted their borrowing powers, and they would remember that at a meeting in June it was agreed to extend the borrowing powers to the extent of £300,000. They were waiting for an opportunity for issuing further capital, and until that time arrived they had made satisfactory arrangements with their bankers whereby they would get temporary loans, and as security they had the £200,000 second debentures. The amount borrowed at the end of the financial year was £35,000. Speaking generally about the business, they had some 42 miles operating, 31 of which were leased from various local authorities, and the remaining 11 they owned themselves. The full number of miles authorised was 64, but it seemed extremely unlikely that for some years to come they would attempt to develop more than 54 miles. An unsatisfactory feature of their system which would shortly be removed was the present detached sections. For instance, Wood Green and the Great North Road were not physically connected, nor was the Edgware Road with the Great North Road. These gaps would shortly be filled up, and they would then be able to run continuously some 22½ miles from the North-East corner of their system at Waltham Cross to Wembley, which showed the great importance of their system in the Northern districts. They would extend this year their present terminus at Winchmore Hill to Enfield Town, and also from Willesden to Acton Church. This would necessitate the erection of a repair depôt at Hendon, which they thought would make for economy, besides expediting the time taken in repairs. The Harrow Road line had been engaging the company's attention, and for some 18 months they had been in negotiation with the L.C.C. in connection with the line. They would remember that in 1907 that part of the undertaking in the County Council area, under Sec. 43 of the Tramway Act, should have been taken over by the local authority, and the company promoted a Bill to extend the Harrow Road line from Lock Bridge to the Edgware Road. They went on with that Bill, and they had now come to an arrangement with the London County Council, by means of which they would construct that line which was authorised last year, and for that they had been granted running powers, not only over the new lines, but also over the old ones. They would have a terminus near Edgware Station of the Baker Street and Waterloo Tube. In addition to that, it would be near five other tube railways, and the L.C.C. would also give them important feeders from the Highgate and Finsbury Park lines, which would end up near the new terminus. The new line would, therefore, be served by both railways and trams. Another important branch of their business was the Electric Power Supply Co., and they had received 5 per cent. from that undertaking. In 1907 that company sold 11 million units, as compared with 14 millions last year. That showed that they had a very large and progressive business in that concern, and it was able to take its place as the third or fourth of the large companies in the metropolis. That output was equal to a supply which would light Edinburgh or Bradford. Another undertaking in which they had a large interest, was the Distribution Company, and that also had shown a satisfactory progress. The number of 30-watt lamps in 1907, was 32,710, but it had increased to 45,130. The power company had erected a generating station and dust destructor at St. Albans, which was progressing satisfactorily, and would shortly require more plant. In conclusion, the chairman referred to the admirable manner in which the company was served by Messrs. Mott, Murray, A. L. Barber, and the staff generally, under the able captainship of Mr. Devonport, the general manager.

Mr. C. G. Tegetmeier, in seconding the motion, remarked that the money paid to the Middlesex County Council, was expended in street widenings. Although that local authority provided the lines, yet they (the company) had to earn interest on that money. It was somewhat different in the case of municipal undertakings, where a very large proportion of their expenditure was charged, and he considered rightly charged, in connection with street widenings. No benefit was conferred upon the tramways, but upon the community at large. He was pleased to say that their relations with their employés were most amicable.

The report was adopted.

Anglo-Argentine Tramways Co., Ltd.

The twenty-fifth ordinary general meeting of the above company was held on Wednesday last week at Winchester House, E.C., under the chairmanship of Mr. J. B. Concannon.

In moving the adoption of the report (see Electrical Review, April 9th, page 606), the Chairman said that, as the Buenos Ayres Electric and Belga Argentina Companies were worked by them for the second half of the year only, a comparison between the whole of 1908 and the year 1907 would not convey any useful information, but he would give some interesting figures showing the effects of the fusion up to the end of February last. In the meantime, he would merely point out that, after charging revenue with £48,000, which they had carried to the depreciation renewals fund, and allowing for the City Co.'s annuity and the interest and sinking fund on the debentures and dividends on both classes of preference shares and the proportion of sinking fund on the latter, and on the ordinary shares for the year, the revenue accounts showed a surplus of £101,939. From that figure had to be deducted the payment of £30,250, being the final payment of interest to June 30th last on the purchase money of the Buenos Ayres and Belgrano Tramways, £3,100 voted to the retiring directors, and payment of the interim dividend on 40,000 ordinary

shares for the half-year ending June 30th, and allowing for a dividend of 6½ per cent. per annum for the second half-year, which the directors now recommended should be paid on the 300,000 ordinary shares, a balance of £12,839 remained to be carried forward. As regarded the various companies which they had absorbed, he would only mention that the Grand National and La Capital Traction and Electric Companies' systems were being worked by the Anglo Co. as from the first day of this month. When commenting this time last year upon the amount annually charged to revenue and credited to the depreciation renewal funds, he intimated that the board would submit the question to an exhaustive examination, with a view of arriving at a closer approximation of the figure which should in future be charged to revenue each year. This they had done, and taking into consideration the fact that they now had a total sum of over £300,000 standing to the credit of the reserve and depreciation renewals funds, and invested in first-class securities, they came to the conclusion that £48,000 was amply sufficient in respect of the year 1908. They would, of course, continue to charge the depreciation funds balance to the sums annually expended upon actual renewals; £32,742 was spent upon renewals during the year 1908, and, in addition, a sum of no less than £136,744 was expended upon ordinary maintenance and debited to revenue. As regarded the results they were likely to arrive at when the necessary junctions and additions to track were constructed to allow of the entire combination being run systematically and economically as one complete whole, he thought they might safely rely upon the experience they had gained so far as an indication of what they might look for in the future. Now, although they were working the Belgrano system from July 1st, 1907, and the Buenos Ayres Electric and the Belga Argentine systems from July, 1908, they were only able to run new services in combination with the Anglo as from October 1st last, and the result had been that, for the quarter ending December 31st, the total combined receipts showed an increase of 10·72 per cent., and the working expenses came down from 57·09 per cent. to 55·46 per cent., against the corresponding quarter in 1907, while for the months of January and February this year, the net profit amounted to £95,249, being an increase of £11,009, or 13 per cent., so that he thought it was reasonable to expect further large increases in net receipts, when they were in a position to work new services over the Grand National and La Capital Traction Co.'s lines, in combination with their present systems, especially when he reminded them that these systems were far larger and more important than those of the Belgrano, Buenos Ayres Electric, and Belga Argentine. To sum up, they anticipated that the results for this current year, although a period of transition, would, after providing for all prior charges, leave a balance sufficient to pay a satisfactory dividend on the ordinary shares, while they looked for a further substantial improvement in the net revenue in 1910 and subsequent years.

Mr. E. A. Lazarus seconded the motion.

Mr. Walker asked what the position of the company's Parliamentary Bill was.

The Chairman said the Bill had passed the House of Lords, and was not being opposed in the House of Commons.

The motion was adopted, and subsequently a resolution was passed voting a special fee of 5,000 guineas to the chairman for the great services he had rendered the company, particularly in connection with the negotiations for the various amalgamations.

The Chairman said that, large as the grant made to him was, yet he regarded the sentiment which had moved his friends to pay him the compliment much more. Although they were now in smooth water, yet they had a very great undertaking to deal with. They now controlled 1,407 motor-cars and 631 trailers, and owned 300 miles of line.

Indo-European Telegraph Co., Ltd.

The directors in their report for 1908, announce that they have been successful in obtaining an extension of the Persian Concession for a period of 20 years from January, 1925. The International Telegraph Conference, at which the company was duly represented, was held last year at Lisbon. The tariff modifications decided upon will not materially affect the company's receipts. Direct Wheatstone working (without intermediate retransmission) hitherto in operation between London (Manchester and Liverpool) and Teheran, has been extended to Karachi by the co-operation of the Indo-European Telegraph Department of the India Office, and is in daily use for telegrams exchanged with India and the Far East. The former retransmission at Teheran has thus been eliminated with consequent gain to the telegraphing public in respect both of speed and of accuracy. The company's revenue from message account and other sources as shown in the revenue account amounts to £132,837, as compared with £136,579 for 1907, showing a decrease of £3,742. The expenses are, on commercial and general account £49,926, and on maintenance account £25,808, making a total of £75,734, as against £73,053 for 1907, showing an increase of £2,681. The revenue account therefore shows a balance of £57,103, which is carried to profit and loss account, 1908, and after deduction of income-tax paid is reduced to £53,601. To this is added the balance of profit for 1907 brought forward of £8,558, and £549 profit on realisation of investments, making a total of £62,709. The directors have considered it advisable to set aside the sum of £5,000 to meet line repair contingencies. Deducting this sum and the interim dividend of £10,625 already paid, there remains a balance of £47,084 available for distribution. The directors now propose to declare a dividend for the six months ending December 31st, 1908, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax, and to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments. This distribution, also, will be free of income-tax. They also propose to hand over to the trustees of the retirement trust fund a further sum of £5,000, carrying forward £10,209 to the credit of 1909. Notice has been received from a shareholder (Mr. von Chauvin, of Messrs. Siemens Bros. & Co., Ltd.), that he will at the meeting, in accordance with the intimation given by him at the last general meeting of the company, propose a resolution in the following terms, viz.:—"That a special sum of £3,000 be voted to the directors in recognition of their past services to the company, to be divided among them in such manner as they may determine."

North Metropolitan Electric Power Supply Co.

Sir E. Spencer presided at the Electrical Federation Offices, Kingsway, W.C., on Tuesday, last week, over the ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, April 9th, page 606), the Chairman said that it would be seen that the revenue for the year amounted to £74,874, which compared with £59,373 in 1907. The expenditure was £43,213, and was only £6,961 greater than in the previous year, and the balance at the credit of the account was £31,661, which compared with £23,121 in 1907, a very satisfactory increase of £8,540. Before passing from this account he would like to mention that owing to the favourable coal contracts made in the course of the year, they were able at the end of the year to reduce their works costs of generation to a figure substantially below that of the previous year. Another satisfactory feature of the account was that the receipts from the sale of energy had increased from £58,749 to £74,304, an increase of £15,555, which was equal to 26·4 per cent. The number of Board of Trade units sold and represented by these receipts was 14,069,611, which was nearly three million more units than in 1907, and was equal to an increase of 25 per cent. The energy was supplied to (1) the Metropolitan Electric Tramways, Ltd., for the working of the whole of the large system of over 40 miles of tramways and light railways operated by that company, in conjunction with the County Councils of Middlesex and Hertfordshire; (2) the supply of bulk to the Willesden Council for distribution throughout the large urban district by the Council; (3) the bulk supply to the Stoke Newington Borough Council; (4) the bulk supply to the Hendon Electric Supply Co., Ltd., for distribution in the area of supply of that company, which covered the Hendon Electric Supply Co. and the Hampstead Garden Suburb; (5) the North Metropolitan Electrical Power Distribution Co., Ltd., for distribution by that company in Barnet, Enfield, Hertford, and St. Albans; (6) in Edmonton and Tottenham where they themselves distributed to the private consumer under the Electric Lighting Orders for those two large districts; and (7) for the supply for "power" purposes to numerous large manufacturers in Tottenham, Edmonton and the Lea Valley district. Fresh agreements were constantly being entered into, and they had every reason to anticipate a rapidly increasing output in this last direction. The area over which their supply was available had the great advantage of being near to London, and this was very essential to a large number of manufacturers, whilst, at the same time, it was just outside the London County Council's area, and therefore the stringent building regulations of that Council were avoided, and further, there was plenty of land for new works and excellent rail and water facilities. Turning to the net revenue account, they would see that amounts had to be added to the balance brought from the revenue account in respect of interest receivable, and the profit upon the electric lighting undertaking of the Stoke Newington Borough Council. In 1907 they had to deal with a deficit of £839 11s. 1d., being the loss upon the working of that undertaking, and it was gratifying that this year a payment of £1,289 10s. 2d. had been received from the Council. They were not, however, receiving a dividend upon their investment in the North Metropolitan Electrical Power Distribution Co., Ltd., for the past year, whereas, in 1907, they received approximately £600 in this respect. He was glad to say, however, that the result of last year's working of the company was quite successful; in fact, the gross profit was £1,4,99 as compared with £642 in the previous year, but the directors of that company had decided to appropriate practically the whole of this amount in the writing off of preliminary expenses and cost of provisional orders, and to place the balance to depreciation account. The sum of £2,000 which had been credited to the reserve was in accordance with the trust deed to secure the mortgage debentures which provided that a sum of not less than £2,000 should be set aside out of the profit each year for the redemption of the debentures. The expenditure upon capital account had amounted to £60,711 during the year. This had chiefly been in connection with the new power station and refuse destructor at St. Albans, and the mains in connection with the undertaking under the Edmonton and Tottenham orders. On the debit side the mortgage debenture capital now stood at £126,500, the sum of £48,400 having been paid up during the year. In conclusion, the chairman referred to the company's Bill in Parliament this session with regard to which they hoped soon to receive the Royal Assent. He thought they would agree that very satisfactory progress had been made by the company during the past year, and the directors saw no reason why this progress should not be continued in the present and future years.

Mr. W. L. Madgen seconded the motion, which was carried.

A dividend at the rate of 5 per cent. was declared.

Woking Electric Supply Co., Ltd.

At the annual general meeting held recently, Mr. John Ashby presided, and, in moving the adoption of the report, he said that the change-over from supplying at a voltage of 100 to supplying current at 200, cost a considerable sum of money, but it had now been written off. The only item in the accounts that perhaps required any observation from him, was the amount of revenue, which was £14,453, an increase on the previous year, but not as large as the annual increases which they had been in the habit of seeing. This was accounted for in two ways. First of all, last year was an exceedingly fine year, with a good deal too much sunlight. Then last summer was an exceptionally fine one, with long light evenings, and that made a good deal of difference to their revenue. A further reason was to be found in metallic-filament lamps. It was thought by some that the introduction of these lamps would be detrimental to electric light companies. In their opinion such would not be the case. They welcomed any improvement in lamps which would make electricity cheaper, and more convenient for the ordinary consumer. The man who invented a lamp which would be more efficient, and give an equivalent amount of light at a lower cost, was a benefactor in the long run to all electric light companies. Possibly during the transition stage from one sort of lamp to the other, there might be a temporary falling off in the amount of the annual increases, but it would only be temporary. Coal was dearer last year, but notwithstanding that, with their improved machinery and boilers, and improved draught with their expensive chimney and so forth, the extra cost of coal last year was only about £94 more than in the previous year, and this year they had entered into a favourable contract for the purchase of coal enough to last for more than twelve months, and they looked forward to a considerable saving with an increased output.

Mr. H. W. Bowden seconded the adoption of the report, and it was carried.

Bath Electric Tramways, Ltd.

On Wednesday, April 7th, Sir James Sivewright presided over the sixth ordinary general meeting of this company, held at Winchester House.

In moving the adoption of the report, the Chairman, after referring to the resignation of Sir Vincent Cailliard from the board, through pressure of other engagements, said he regretted that at that meeting, the first at which he had the honour to address them as chairman, he could not submit better accounts. But the circumstances had been against the company, and the results compared unfavourably with those of previous years. In that respect they were by no means singular. There was no doubt that the majority of tramway undertakings had been similarly affected. No branch of business was more affected by the climatic conditions than was a tramway system. The traffic receipts showed a diminution as compared with last year, and that was mainly due to two causes. The first was the depression of trade, which had prevented people from spending money to the same extent as they did in good times, and that loss had been accentuated by periods of indifferent weather. A barometer did not reflect climatic conditions more accurately than the receipts of a tramway company. The two best months for them were August and September, and, as they were aware, in the latter part of August and during the whole of September they had bad weather, which seriously interfered with their takings. He was pleased to say that the diminution shown in the earnings had been fully compensated for by the savings which had been effected in the expenditure. That was particularly gratifying, for when a company got down to a certain figure it was extremely difficult to get below it. The savings had been effected without in any way sacrificing the efficiency of the line. Their engineer, who had been with them since they started, Mr. Mac Carter, had made a report in which he said that the whole of the tramways in every branch had been well and efficiently maintained, and were in good order at the present time, and the system, as a whole, was in an excellent condition. Turning to the accounts, the balance-sheet practically remained the same. The traffic and parcels receipts and advertising were £38,394, as compared with £41,451, a drop of £3,057. That amount was divided between the tramways and the motor-'buses—the actual decreases were, cars £1,700, and motor-'buses £1,334. They had been, however, able to decrease the operating costs on the 'buses by a substantial amount. It might be said that as the 'buses had shown a loss for so many years, they should drop them. He would point out that they were an indirect source of revenue; they brought the traffic to their tramways, and they had decided to keep them running. The balance brought forward was £2,489, and they had an available balance of £14,626. They had paid the interest on the debentures and preference shares, and under the trust deed with the debenture-holders they had to provide for a sinking fund for the redemption of debentures. During the past year they devoted £1,000 to that account. On the debit side they would see there was a saving in all the expenses except that of repairs and renewals, which showed an increase of £282. As to the future, it was rather difficult to make any forecast, but it was satisfactory to note that the receipts so far in the current year had been maintained, and they were able to show a net increase of £200 over the corresponding period last year. They had been authorised by the Board of Trade to make an increased charge on their western line, and that should bring them in a larger revenue. If they had anything like decent weather they hoped to show increased receipts for the current year. As an instance of how the weather affected the revenue, he might mention that from April 1st to 6th they showed an increase of £20, and Sunday, April 4th, showed an increase in the receipts of nearly £11. In the place of Sir Vincent Cailliard, the board proposed to elect his brother, Mr. Esmond Cailliard, to fill the vacancy.

Mr. Clutterbuck seconded the motion, and remarked that he hoped the coming year would show an improvement. Bath was purely a residential city, and people simply travelled for pleasure. There were no large factories or workshops which employed a great number of hands, and from whom the company could derive a revenue.

Mr. Charles S. Bright complained of the money which was being placed to the reserve, and said that he most strongly protested against money being placed to that fund when the company declared no dividend on the ordinary shares.

Mr. Hunter asked that more detailed information should be given in the report. He criticised the accounts at some length, and remarked that whilst in 1905 the expenses were £22,169, now in 1908, although the traffic receipts had only gone up £3,000, the expenses had risen to £26,257. He thought that the percentage of expenses to the ratio of receipts was very excessive. He considered that as the company had paid no dividend on the ordinary shares, the directors ought not to take such large fees.

Mr. MacKey also complained of the heavy expenses.

Mr. Crisp said that as practical men they must either make the best of the men whom they had on the board or else replace them by men who would do better. The board should see what could be done to wipe out the debt overhanging the company and, if need be, approach the debenture-holders to see if they would suspend the sinking account. He proposed to call a meeting of the shareholders, and, if possible, arrange some policy, and he hoped that the board would see their way to meet any recommendations which that meeting of shareholders might make to them.

The Chairman, in reply, said that if the shareholders thought they could get better men on the board who would declare a dividend, he and his colleagues would have no hesitation in making way for those gentlemen. He had a very large interest in the company, for he owned £10,000 preferred ordinary shares. As to the directors' fees, they had not taken anything for over nine months. With reference to the proposed shareholders' meeting, he did not think it would serve any good purpose, for, as they knew, a house divided against itself was rather an awkward building to be in.

The report was adopted.

Calcutta Tramways Co., Ltd.—The report for 1908 states that Calcutta receipts amounted to £162,725, and Howrah to £2,820, total £165,547; working expenses were, in Calcutta, £103,348, and in Howrah, £3,452, total £106,800. The revenue balance is therefore £58,747, plus interest received and balance forward, making £60,592. Interest on debenture stock and bank advances and dividend on preference and ordinary shares paid absorbed £41,498, leaving an available balance of £19,094. The directors propose the payment of a final dividend of 2s. per share making 4 per cent. for the year; adding to the depreciation fund £5,000 and carrying forward £333. The depreciation fund at the commencement of the year stood at £48,080. After adding thereto £2,186, interest on investments, and £5,000 proposed to be allocated, as above, and deducting £5,311 written off for renewals during the year, the fund will stand at £49,955. The traffic receipts on the Calcutta system show a decrease on the previous year of £4,711, or 3 per cent., due to slacker traffic. The reason for this have been the general depression in trade, the continued high price of food grains, the decreased number of people visiting Calcutta owing to the political unrest, and the abnormal rainfall.

Brisbane Electric Tramways Investment Co., Ltd.—The directors report that the revenue account for the year 1908, including £2,130 brought forward, shows an available balance of £61,220. Debenture stock interest has absorbed £19,237; preference dividend, £17,812; and interim dividend of 2s. 6d. per share on the ordinary shares, £9,375. Out of the available balance of £14,795 the directors recommend that a balance dividend of 3s. 6d. per share, free of income-tax, be paid on the ordinary shares (making a total dividend for the year of 6 per cent.), and that £1,670 be carried forward. The appropriation of the available balance of the tramways company, of which this company holds all the shares, includes an allocation to renewals fund of £18,000, bringing the reserve and renewals funds of both companies to a total of £71,216, with an aggregate of balances carried forward of £2,511.

Arbroath Electric Light and Power Co., Ltd.—In moving the adoption of the report at the annual meeting on Monday, Mr. George Balfour expressed the satisfaction of the directors at the support accorded to the company. He also pointed out that the cost of production at the company's power station was exceedingly low, and compared very favourably with that at other towns and at many of the large cities both in England and Scotland. The resolution was agreed to. The profit and loss account shows a profit for the period from August 19th, 1908, when the works were opened, up to December 31st, of £128. This amount is to be carried forward.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—A dividend has been declared on the preference shares at the rate of 6 per cent. per annum for the six months ended March 31st.

Mexico Tramways Co., Ltd.—The directors announce a dividend of 1½ per cent. for the quarter ended March 31st, 1909.

MARKET QUOTATIONS

Wednesday, April 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£23 10	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4d.	5d. dec.
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt	77/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£10 15	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£50 to £135	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	8½d.	..
c „ „ (solid drawn)	„	7¾d.	..
c „ Wire, basis	„	6¼d.	..
c Copper Tubes (brazed)	„	9⅝d.	..
c „ „ (solid drawn	„	9⅜d.	..
g „ Bars (best selected)	per ton	£71	..
g „ Sheet	„	£71	..
g „ Rod	„	£71	..
e „ (Electrolytic) Bars	„	£59	..
e „ „ Sheets	„	£75 10	..
e „ „ Rod	„	£63 10	..
e „ „ H.C. Wire	per lb.	7 1/32d.	..
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	5/3½	½d. inc.
l Iron Pig (Cleveland warrants)	per ton	48/-	1/- inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 15	5s. dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 7 6	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	1/- to 1/1	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6	..
o Platinum	per oz.	100/-	variable.
e Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£133 to £134	£1 10s. dec.
n „ Wire, Nos. 1 to 16	per lb.	1/8½	..
p White Anti-friction Metals:— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vielle Montagne bnd.)	„	£25	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Aluminium Corporation, Ltd.—By an order dated April 6th, Mr. Registrar Hood has directed separate meetings of (1) unsecured creditors whose respective claims amount to over £10; (2) the holders of participating preference shares; and (3) the holders of ordinary shares, for the purpose of considering a scheme of arrangement proposed between the company and the creditors, to be held on Tuesday, April 27th, at Winchester House, E.C.

Guildford Electricity Supply Co., Ltd.—Mr. H. P. Smallpiece presided at the meeting held recently. The report showed a gross receipts increase of £306, and the balance on revenue account was £3,168 (after crediting depreciation fund with £1,000), as compared with £2,932 in 1907. During the year a new Diesel oil engine and dynamo were laid down. The lighting units increased from 236 692 to 244,204, and those for power from 68,165 to 90,528. A dividend of 5 per cent. on the ordinary shares has been declared.

Telephone Company of Egypt, Ltd.—The directors recommend a dividend of 4 per cent. (4s. per share), less income-tax, on both the preferred and deferred shares for the past half-year, making 10 per cent. for the year, placing £500 to reserve for contemplated pension scheme, and carrying £25,782 forward.

STOCKS AND SHARES.

Tuesday Afternoon.

The Stock Exchange reassembled in a very hopeful frame of mind after the Easter holidays. Since the closing of the Balkans incident, more than a fortnight ago, the movement of prices has been almost uninterruptedly forward, and the buying for account of investment makes a most useful supplement to the still greater volume of purchases made by the professional divisions.

To lend money at anything like remunerative rates is now a matter of pronounced difficulty, and the capital which is being forced into the markets is spreading over all sections of the Stock Exchange, the electrical departments being by no means overlooked.

Home Railway stocks are enjoying a boomlet for which fine holiday weather, cheaper money and the hopes of better trade are jointly responsible. The passenger lines took the lead in an advance which gradually extended even to the Underground stocks. Central London Deferred rose no less than 4 points, the Ordinary and Preference a point apiece and City and South London 2½, although for all of them the inquiry has so far proved quite moderate. Metropolitan Consolidated rather hung back, but the Surplus Lands stock is better, and Districts rose ¼ to 14¾.

Both the Great Northern and the Charing Cross Tube Debenture stocks are higher, at 93, and the improvement in the traffics of the group has led to further demand for the issues of the Underground Electric Railways. The income bonds rose 4, the 4½ per cent. bonds—already indicated here as good speculative investments—gained 1, and the prior lien bonds are a little higher.

Other sharp rises are to be found in the Candian-Mexican division. Mexican Trams rose 4½ to 142½, and the bonds ⅜ to 94¼. Sao Paulo Trams are quiet at 157. Canadian General Preference is 3 higher at 116, the Common shares remaining at 114. A point rise took Montreal Light, Heat and Power capital stock to 117, and Shawinigan capital stock is firm at 97½; Mexican Light and Power Common stock regained its fall of the previous week.

Indications were not wanting that the public treated the new issue of the Victoria Falls Power Company with a certain degree of coolness. Maybe the public thought that the original coolness lay with directors who offered new shares at 20s. when old shares were obtainable at 1s. cheaper in the market. The price of the old is still about 19s.

Electricity Supply shares are quiet, and show few alterations in price. City of London Preference continue to slide, and have lost a further 5s. Otherwise the movements are favourable to holders. Newcastle-on-Tyne Ordinary shares have recovered 10s., and are up to 5 again. The Preference rose ½. St. James's shares rose 7s. 6d., Westminsters 10s., and Notting Hill shares at 11½ are 5s. to the good. Several Debenture stocks have been marked up, and such securities are becoming more difficult to buy, as a rule, than to sell. There are many instances in which stocks can be realised at the middle prices, or better, a fact of which certain bucket-shops take full advantage. Getting orders from the public to sell stock, they execute these at net quotations governed by the prices, the lower prices, in the Stock Exchange Official List. That there can be people so silly as to submit to robbery of this order would be difficult to credit were not examples of such folly brought constantly under notice. The dictum that people who are so credulous as to deal with bucket-shops deserve to be swindled, covers only part of the truth.

While telegraph descriptions are, on the whole, colourless, a rise of 5 in American Telephone and Telegraph capital stock stands out as the main feature of this section. The remarkable boom in American Railroad shares goes merrily on, and everything American is rose-hued for the time being. National Telephone stocks are good, and United River Plate have hardened a small fraction.

Amongst manufacturing shares, Babcock & Wilcox are ⅛ easier, and Vickers, with Armstrongs, declined from their top prices, the *Dreadnought* fever cooling. However, it has run high enough to attract attention to Willans & Robinson Debenture stock, which at 74 displays a 3 point rise. British Aluminium issues are unsteady in anticipation of the new Debenture stock, which is expected to make its appearance this month or early in May.

Italy.—The report of the Societa Elettricita Alta-Italia, of Turin, for the last financial year shows a net profit of £61,926. A dividend of 5 per cent. is being declared, the same as for the preceding 12 months.

Babcock & Wilcox, Ltd.—A dividend and bonus amounting, with the interim dividend already declared, to 20 per cent. for 1908, have been announced.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations April 3rd.	Closing Quotations April 13th.	Business done week ended April 13th, 1909. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2¼ — 3¼	2⅜ — 3¼	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 6 5
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½ %	8 %	8 %	..	134½—135½xd	139½—140½	141½	134⅞	+5	5 13 11
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	98 —100	..	..	+1	4 0 0
598,180	Anglo-American Telegraph	Stock	3½ %	3½ %	3½ %	£3 4s.	55 — 58	55 — 58	55	..	..	5 5 3
8,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —101	100 —102	101⅜	100½	+1	5 17 10
8,200,910	Do. do. do. Deferred	Stock	1½ %	1½ %	1 %	8/-	14⅛— 14½	14⅛— 14⅜	14 7/16	14⅛	— ⅛	2 16 3
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	98 —100	98 —100	..	..	..	5 0 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅞— 8⅜	7⅞— 8⅜	..	..	..	4 15 6
2,481,350	Commercial Cable Stng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87 xd	86 — 88	86½	..	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	..	7⅞— 8⅜	7⅞— 8⅜	..	..	..	6 17 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½— 17½	17 — 18	..	..	+ ½	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8½	8 — 8½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½ — 9	8½ — 9½	..	..	+ ½	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	3 16 6
60,710£	Direct United States Cable	20	4½ %	4½ %	4½ %	4½ %	12½ — 12⅝xd	12½ — 12⅝	..	..	..	6 9 3
48,000£	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	129½ —132½	130½ —132½	131	129⅝	..	5 5 3
2,000,000	Do. 5½ % Pref. Stock	100	5½ %	5½ %	5½ %	..	85 — 87	85 — 87	86¼	85	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104 —106	104 —106	..	..	..	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅞— 12⅜	11⅞— 12⅜	12 7/16	11 11/16	..	5 13 4
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000£	East & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	101 —103	..	..	+1	3 17 8
181,127	Globe Telegraph and Trust	10	5½ %	5½ %	5½ %	..	10⅜— 10⅝xd	10⅜— 10⅝	10⅜	10 5/16	..	5 8 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	12⅜— 12⅝xd	12⅜— 12⅝	12⅜	12 1/16	..	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18%	29½ — 31½	29 — 31	30 1/16	30	— ½	5 16 2
14,800£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	52 — 55	52 — 55	..	..	..	6 18 11
£41,880,400	Mackay Companies Common	$100	2 %	5½%	4 %	4 %	72 — 77	72 — 77	..	..	..	5 3 11
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 75	71 — 76	..	..	+1	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	16/9	16/8	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	3/16 — 7/16	3/16 — 7/16	19/-	..	..	6 0 9
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	3/16 — 7/16	3/16 — 7/16	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	105⅜—107½	106 —108	107	106⅜	+ ½	5 11 1
5,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120½—122½	120½—122½	121⅛	120⅛	..	4 18 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11½	10½— 11½	..	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 11½	10½— 11½	..	..	..	5 6 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 3/16	5 1/16	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½ %	3½ %	3½ %	3½ %	98 —100	98 —100	98½	98⅜	..	3 10 0
1,716,698	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	..	1⅝— 1⅞	1⅝— 1⅞	..	..	..	5 17 8
50,000	Do. do. do. 6 % Cum. Pref.... ..	1	6 %	6 %	6 %	..	1⅝— 1⅞	1⅝— 1⅞	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	89	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889£	Reuter's	8	5 %	5 %	5 %	..	7½— 8½	7½— 8½	..	..	..	4 17 7
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½ %	4½ %	4½ %	4½ %	99 —101	100 —102	..	..	+1	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅝— 7	6⅞— 7	6 13/16	6⅞	+ ⅛	5 14 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000 ..	5	5 %	5 %	5 %	5 %	4⅛— 5⅜	4⅛— 5⅜	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 16 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	12⅞— 13⅜	13 — 13½	13⅛	13 1/16	+ ⅛	5 8 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102⅛	101½	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	7⅛— 8⅛	7⅛— 8⅛	8⅛	7⅛	..	7 3 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7⅛— 8⅛	7⅛— 8⅛	7⅛	..	..	2 14 1
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	10 %	8⅞— 9⅛	9 — 9¼	9⅛	8 31/32	+ ⅛	5 8 1
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅝%	5⅝%	5⅝%	6 %	6 — 6½	6 1/16— 6 5/16	6½	6 1/16	+ 1/16	4 15 10
266,600	Do. Old, 6 % Deb. Stock, 1888 ..	100	6 %	6 %	6 %	6 %	..	..	..	..	..	4 4 6
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	..	4 3/16— 4 5/16	4⅛— 4⅛	85/7½	82/6	— 1/16	4 14 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1½— 1⅝	1½— 1⅝	26/3	..	..	20 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅜— 3½	2⅜— 3⅛	60/-	55/-	— ⅛	11 4 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3½— 4	3⅝— 4	..	..	..	7 10 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3½— 4½	3½— 4½	..	..	..	4 8 11
124,400	Do. do. 5% Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 98	95 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —146	142 —146	142⅜	..	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —124	121 —125	122½	..	+1	4 16 0
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 —108	107 —109	108½	106	+1	4 11 9
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½ %	4½ %	4½ %	4½ %	102½—104½	102½—104½	..	..	..	10 16 3
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½ %	4½ %	4½ %	4½ %	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	10	3 %	Nil	Nil	..	3/16— 7/16	3/16— 7/16	15/-	12/6	—1/16	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2½— 3	2½— 3	50/-	46/8	— ⅜	11 8 7
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 89 xd	84 — 88	86	85½	—1	5 13 8
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	70 — 75	68 — 73	..	..	..	6 3 3
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	6⅝— 7⅛	6⅝— 7⅛	7⅜	7	—2	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅜	6 — 6⅜	6 3/16	..	..	4 14 1
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	100	4½ %	4½ %	4½ %	4½ %	104 —107	104 —107	..	..	..	4 4 1
308,440	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½ %	4½ %	4½ %	4½ %	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	38 — 43	38 — 43	..	..	..	9 6 0
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	5/16— 11/16	5/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,276	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	..	0 — ¼	0 — ¼	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	0 — ¼	0 — ¼	..	..	..	Nil
125,000£	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	57 — 62	56 — 61	..	..	—1	7 7 7
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	38 — 38	38 — 38	..	..	..	10 16 10
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	..	4½ — 5	4½ — 5	..	..	..	6 0 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	5⅛	96/3	..	4 13 0
950,000	Do. 4½ % 1st Deb. Stock..	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	100½	100	..	4 8 8
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9½— 10½	9½— 10½	..	..	..	7 2 10
40,000	Do. do. 6 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½ %	4½ %	4½ %	4½ %	105 —107	105 —107	..	..	..	4 4 1
491,229	Cape E Trams., 1 to 491,229	1	Nil	Nil	Nil	..	3/16— 7/16	3/16— 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	6 17 2
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½ %	4½ %	4½ %	..	103 —107	103 —107	..	..	..	4 4 1
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	64 — 66	65 — 67	67	65	+1	4 17 0
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	82 — 84	83 — 85	85	84	+1	4 14 2
553,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	45 — 47	49 — 51	47	..	+4	4 14 2
1,480,000	City and South London Railway	Stock	1½%	2½%	2½%	1½%	29½— 29½	31 — 32	31	29½	+2½	4 18 0
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	1 — 1½	1 — 1½	..	..	..	9 7 6
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	95 — 98	95 — 98	..	..	..	5 2 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Apr. 3rd.	Closing Quotations Apr. 13th.	Business done week ended Apr. 13th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 31/32 — 1 15/16 xd	1 31/32 — 1 15/16	..	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6 %	6¼%	6 %	11 1/16 — 11 3/16	11 1/16 — 11 3/16	..	..	..	4 16 6
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12 1/16 — 13 1/16	12 1/16 — 13 1/16	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	4½%	4½%	..	1/16 — 1/8	1/16 — 1/8	..	..	..	20 0 0
17,189	Do. "A" shares, 01—017,189	5	4½%	4½%	4½%	..	1 1/16 — 2 1/16	1 1/16 — 2 1/16	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	75 — 78	75 — 78	..	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87 xd.	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
31,290	Do. do. 7 % Cum. Pref., 1 to 31,290	2	7 %	7 %	7 %	7 %	1 — 1 1/16	1 — 1 1/16	..	..	..	11 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 3/16 — 7 5/16	7 3/16 — 7 5/16	..	..	..	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 89	83 — 87	..	..	—2	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10 3/16 — 10 5/16	10 3/16 — 10 5/16	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11 3/16 — 12 3/16	11 3/16 — 12 3/16	..	..	..	6 0 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5 1/16	5 — 5 1/16	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	..	15 — 16	15 — 16	15	..	..	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	1 — 1 1/16	1 — 1 1/16	..	..	..	5 6 8
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4 1/16 — 5 1/16	4 1/16 — 5 1/16	..	..	..	9 10 6
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	3 %	Nil	2 — 3	2 — 3	..	..	..	4 8 11
399,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	3 1/16 — 4	3 1/16 — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5⅜%	3 — 4	3 — 4	66/3	..	..	9 7 6
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	..	4 %	69 — 74	69 — 74	70½	70	..	5 8 1
5,722,062	Metropolitan Consolidated	100	2⅜%	1 ⅜%	⅜%	⅜%	36 — 37	36 — 37	37	36⅝	..	1 7 0
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	68 — 70	69 — 71	69⅜	69¼	+ 1	3 17 6
3,385,000	Do. District	100	Nil	Nil	Nil	Nil	14½ — 14⅝	14½ — 15	14 5/16	14⅜	+ ½	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	1 1/16 — 1 1/8	..	..	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/-	..	..	..	Nil
800,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	15/16 — 1	16/3	15/6	..	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94 — 96	93 — 96	96⅜	96¼	..	4 13 9
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	137 —139	141½ —143½	144½	138	+4½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	93 — 94	93½ — 94½	94½	93½	+ ½	5 5 6
245,500	Potteries E. Tro.	1	4 %	4 %	4 %	4 %	1/16 — 1/8	1/16 — 1/8	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	89 — 91	88 — 91	..	..	..	4 18 11
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	32 — 34	32 — 34	..	..	..	5 14 10
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	101 —103	102 —103	103	102¾	+ ¼	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	83 — 85	84 — 86	84½	..	+ 1	5 4 8
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	30 — 32	34 — 36	35⅞	35	+ 4	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	Nil	5/8 — 11/16	5/8 — 11/16	18/-	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	12 0 0
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	69 — 73	68 — 72	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Brownley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4 1/16 — 5	4 1/16 — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
80,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 1/16 — 8 3/16	8 1/16 — 8 3/16	8 1/8	8 5/16	..	5 14 3
2,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8 1/16	8 — 8 1/16	..	..	..	4 2 4
396,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3 1/16 — 4 1/16	3 1/16 — 4 1/16	78/9	..	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4 1/16	4 — 4 1/16	87/6	83/9	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3 15/16 — 4 1/16	3 15/16 — 4 1/16	..	..	..	5 9 1
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3 3/16 — 3 5/16	3 3/16 — 3 5/16	76/-	..	..	5 16 2
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10 1/16 — 10 3/16 xd	10 1/16 — 10 3/16	10 1/8	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 12 1/16 xd	11 15/16 — 12 1/16	12 1/16	12	— 1/16	4 16 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	101 —104	..	..	+1	4 6 7
60,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2 3/16 — 3 1/16	..	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	3 1/16 — 3 3/16	3 1/16 — 3 3/16	..	..	..	6 13 4
270,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8 1/16 — 8 3/16 xd	8 1/16 — 8 3/16	..	..	..	5 9 7
50,997	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 1/16 — 11 xd	10 1/16 — 11	10 1/8	10 1/16	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	106 —109	107½	..	+1	4 2 7
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	101 —104	103	..	+1	4 6 7
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 62	59 — 62	..	..	..	7 0 8
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	5 %	85 — 87	85 — 87	86	85½	..	5 14 11
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4 1/16 — 5	4 1/16 — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5 1/16	5 — 5 1/16	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7 15/16 — 7 3/8 xd	7 15/16 — 7 3/8	..	..	..	5 9 8
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —101	99½	..	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 1/16 — 7 3/16	7 1/16 — 7 3/16	..	..	..	6 1 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 96	93 — 96	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1 15/16 — 2 1/16	1 15/16 — 2 1/16	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5 1/16	5 — 5 1/16	5 3/16	..	..	5 11 8
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	92 — 96	..	..	..	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 15/16 — 5 1/16	4 15/16 — 5 1/16	95/7½	95/-	..	4 17 7
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 15/16 — 5 1/16	4 15/16 — 5 1/16	..	..	..	4 17 7
120,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000	Do. 5½ % Mort. Deben. Stock Redem.	Stock	5½%	5½%	5½%	5½%	85 — 88	85 — 88	..	..	..	8 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	87 1/16 — 88 1/16	87 1/16 — 88 1/16	88 1/16	88	..	5 13 0
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	77 — 79	78 — 80	79½	77½	+1	4 7 6
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	109 —111	110 —112	111	109½	+1	6 5 0
$19,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	91¼ — 92¼	91 15/16 — 92 15/16	92⅜	91⅛	+ ¼	5 7 10
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4 1/16 — 4 3/16	4 1/16 — 5 1/16	..	..	+ 1/16	8 12 6
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4 3/16 — 5 1/16	5 — 5 1/16	..	..	..	4 13 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	100 —102	..	..	..	..
10,883	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	10 3/16 — 11 3/16	11 — 12	..	..	+ ½	5 16 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6 1/16	6 — 6 1/16	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1 3/16 — 1 5/16	1 7/16 — 1 9/16	27/9	26/3	+ 1/32	5 11 4
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 4 4
194,654	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100 —103	101 —104	..	..	+1	4 16 2
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8 1/16 — 9	8 7/16 — 9 1/16	..	..	+ 3/16	5 6 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7 1/16	7 — 7 1/16	..	..	..	4 13 4
150,000	Do. do. 5½ % Deb. Stock Red.	100	5 %	5½%	5½%	5½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 70	68 — 70	..	..	..	5 11 1
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2 1/16 — 2 3/16	2 1/16 — 2 3/16	50/-	..	..	8 0 0
190,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 — 1/8	1/16 — 1/8	..	..	..	4 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 9 10
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103 xd	100 —103	100½	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1/16 — 1 xd	1/16 — 1	..	..	..	20 0 0
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1 1/16 — 2 xd	1 1/16 — 2	..	..	..	12 10 0
276,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81 xd	78 — 82	80	..	..	5 9 9
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	15/16 — 1 1/16	15/16 — 1	18/9	18/1½	— 1/16	..
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8 1/16 — 9	8 15/16 — 9 1/16	9	8 1/16	+ 1/16	5 1 3
81,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5 1/16	5 — 5 1/16	5	5 1/16	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount, 2½ per cent., April 1st, 1909.

SOME CONSIDERATIONS ON THE USE OF ELECTRICITY IN FOUNDRIES.

By J. W. WARR, A.M.I.E.E.

There are numerous foundries of moderate capacity doing a good miscellaneous jobbing trade of an irregular character, in which the laying down of electrically-driven plant would result in considerable economy. It is, therefore, interesting to consider how electricity can be applied to foundry work, together with a few suggestions as to the best methods to ensure reliability and efficient working. The class of foundry chiefly referred to comprises those that are not connected with engineering factories, but work for the trade generally, for odd customers, and have no speciality.

Commencing with the cranes, we find that though those employed in machine shops, boiler shops and other places are similar to those used in the foundry, they are useless because they are not sufficiently adaptable to foundry work. Overhead travellers, swinging jib cranes, and suspended hoists have now reached a high stage of perfection, and in order to form some approximate idea which of these cranes it is best to adopt it is necessary to note what lies in a day's work. In the early morning boxes have to be opened, and castings turned out and taken to the fettling shed; many of the boxes are taken away and replaced by others from the yard. During the day boxes have to be placed in position, levelled, and turned over, tops lifted, heavy patterns withdrawn, top parts replaced and metal brought from the cupola and poured. Again, the work in one large shop may be light castings, and in another all heavy castings. Then we come to core making, cored work and light loam work. Cores are rammed up in boxes and other work is carried out that is apart from the moulding, cores are lifted from the trestles to the carriages, and after drying are shifted from the carriages to the bogies, &c.

The heavy overhead traveller will not perform the whole range of work in one long bay, since it cannot serve the entire shop at the same time. To multiply the travellers is open to the objection that they are very costly, and usually obstruct each other when trying to serve different parts of the shop; further, they cannot be economically adapted to the rapid handling of light weights. On the other hand, light travellers would be useless when dealing with heavy weights.

Small light cranes, or hoists, are indispensable, and their special value is that a small knot of men can have a crane of this kind all to themselves, instead of having to wait for the overhead traveller to be released from another group of men. Besides, in the case of moulds that are quickly made, a small crane will be found to be constantly occupied, and if it can be easily handled, and has high speeds, it will be found most valuable. The value of the overhead traveller, therefore, lies in the heavier tasks it has to perform.

There is no doubt that the modern reversible three-motor electric traveller is the best piece of hoisting machinery that is now manufactured. The single-motor crane is a clumsy complicated piece of mechanism. The rattling of square shafts, the unsightly and cumbersome tumbler bearing, the great friction, the jerky reversing motions, and lastly, the greasy condition of all working parts, bring it into disfavour. The disadvantages of this type of crane are so obvious, when compared with the all-electric type, that we shall leave it here.

Considerable trouble was experienced a few years ago with the motors, owing to the sulphur fumes and metallic dust attacking them, but with the introduction of the totally enclosed motor this objection has died out. Contrary to early practice, slow-speed motors predominate; their chief advantage is that less reduction gear is necessary, wear and tear is reduced, and the motions are more quickly stopped and reversed. An armature speed of 500 to 600 R.P.M. will be found a most suitable figure. Cut gears are essential for smooth running and economy of operation; worm gears are a wasteful device, even with ball-bearing end thrust, and are better left out.

With the series-wound motor the speed varies with the load. With light load a high speed is obtained, and with a heavy load just the reverse. With a nicely adjusted resistance, especially of the liquid type, the speed has a wide variation from the maximum to a movement so slow that the setting of a core or the drawing of a pattern can be accomplished at an almost imperceptible rate of lift, and at the same time so well under control that the motion can be arrested, or accelerated instantly when both core and pattern are clear of the mould.

A high speed of lift is useless in the foundry, but a quick rate of long and cross traverse is desirable. A lift of 8 ft. per minute will be found to meet all requirements. The other two speeds are subject to the conditions imposed by the size and power of the crane, and should therefore be reasonably selected. High travelling speeds are of value, because the quicker the crane is able to move, the fewer will be the number of auxiliary cranes or hoists required.

On account of high travelling speeds, the risk of lateral weakness tending to bending, over-setting and cross-working has been minimised by stiffening up and widening the cross girders, the latest fish-bellied type of bridge girders being the most common construction for securing safety. The lengthening of the wheel base of the end carriages is also a noticeable feature in modern designs for reinforcing these girders.

The wire rope for lifting seems to have largely displaced chains, probably for the following reasons:—The links are stiff, and subject to large surface friction; deterioration of links; slipping of links, thus setting up jerking, which is liable to spoil a mould or splash the metal whilst being poured. A flaw in a rope is more easily detected than in a chain; a fracture in a link may not be discovered until after an accident has happened.

The designs of the crabs differ considerably; some have cast-iron or I girder frames, others are either of the box or steel plated type. Good bearing surfaces, stiff shafts, bushed bearings, and cut gears are all original departures.

We can now survey a few practical points in the electrical details. For reasons of mechanical strength, carrying capacity, and due allowance for wear, the bare wires of the long traverse motion should be of ample sectional area. Double insulation in series is desirable for straining these wires to the end brackets, also the intermediate porcelain insulators should have broad surfaces to reduce surface leakage due to the clinging of metallic dust. The bare cross traverse wires require the same judicious selection as the long traverse wires. Insulated bushings and washers should have large area, and must not be of a brittle nature. Ebonite is unsuitable as a bushing for collectors; it cannot be subjected to medium compression with a nut without cracking, these cracks affording lodging places for flying dust, and thus setting up leakage and an ultimate burn out.

The position of the long traverse wires is best arranged about 8 ft. over the long traverse girders. This allows a safe path for anyone walking along the girders when the current is on. To run them along the face of these girders can be legitimately considered as a place of safety against shock, but ladders and other articles may be carelessly placed against them, forcing them into contact with the girder, and resulting in considerable damage to the wires. Fixing the cross traverse leads between the cross girders is the usual practice. This has one drawback. Many times a load is not quite within reach of the hook or over dead centre, in which case the hook is deliberately pulled to its work, with the result that the rope or chain comes in contact with the bare wires. In many instances these wires are supported to the left or right of the cross girders, parallel with the crab, to get over this difficulty.

All wiring from the motors to the collectors and from the bare wires to the controllers and switches should be run in light steel conduit. Lead-covered paper or rubber cables should be avoided, as the lead has not sufficient mechanical strength to protect the insulation against vibration, or when being walked on. Main switches and fuses in the cage should be ironclad. Trolley wheel collectors are inferior to the sliding contact type. Any inaccuracy in the lining up of the bare wires will cause the wheel to run off, and besides they are more costly to manufacture.

The fear of the load running down is frequently present, hence the necessity for reliable brake gear. There is little risk in this direction with a substantially constructed electric brake. It is certainly more powerful and reliable than the brakes used on any other class of crane. Shunt, series, and compound-wound brake coils have been used, but the series takes the lead, and wired as it is in series with the hoisting motor, it comes into operation with the latter. When the current is off the brake has a fierce grip, and when the motor is running it is immediately released. In addition to the electric brake, electrical or mechanical supplementary devices are found, as a double safeguard against the load running down. These take the form of a pawl and ratchet brake on some American cranes with which the writer was acquainted.

The advantages of the liquid controller over the wire resistance type have frequently been discussed. For foundry work it is distinctly superior, as a very even torque can be exerted by the motor, owing to the fact that resistance is continuously and gradually cut out. With the wire resistance controller the resistance is cut out by a succession of steps, causing the speed of the motor to be more or less erratic, which is undesirable for mould purposes. There is another drawback with the wire resistance controller: there is a very large amount of wear on the contact fingers and drum rings, and the fine copper dust acccumulating inside has caused a destructive burn out.

In the direction of small cranes, the swinging jib crane, equipped with one or more motors, is of useful service, and if attached to the main stanchions of the building, will not take up floor space. The type of jib crane in which the strut supports the jib is always inconvenient when work is being racked inwards, and the larger the width of the material and the greater the height of lift, the less is the effective range of operation. The best type of jib crane is that in which tie rods support the jib from the top of the mast to the free end of the jib. The utility of the swinging jib crane is limited by the fact that its fixed maximum radius leaves considerable areas that cannot be served. The remedy is to multiply the number, so that the radius of one ends where the next one meets it. The swinging jib traveller has been designed to meet the many requirements of the foundry, but it is objectionable because of the ground space taken up by the track.

Probably the most useful piece of hoisting tackle that has been designed during the past few years is what is termed the electric transporter, run on overhead tracks and serving as many moulders or coremakers as the track covers. The overhead track usually consists of I girders, the transporter being fitted with two motors (series reversible) and switchgear, also accommodation for a driver if necessary, otherwise it can be operated by any person in the shop with ropes fixed to the reversing switches. The system will, no doubt, come into more extensive use than at present, and will effect a revolution in the methods of hoisting and conveying small materials in the foundry. These transporters will be found useful for setting and trying cores, taking away light castings, turning over boxes, bringing material, and carrying small ladles to and from the cupola. In these cases the overhead traveller is almost useless; its power is not required, it is wanted for the heavier work up and down the shop, which is its chief advantage. To anticipate the transporter superseding heavy travellers would be erroneous, but their number may be reduced by the judicious selection of these transporters or their equivalent. Many of the operations just mentioned could be undertaken by the swinging jib crane, but the advantage of the transporter lies in the fact that it can be made to serve a larger area with greater rapidity.

The writer has converted several old types of foundry cranes which were operated by gas and steam engines driving endless ropes, and also hand-operated cranes, the wooden girders being still retained. One particular case was where four men were kept constantly employed on three 12-ton cranes alone, requiring £4 per week for wages. Now, with a motor to each motion, the cost of running has been reduced nearly £2 per week. There was another crane which was steam driven, the engine and boiler being attached to the crab. This crane has rendered valuable service in the past, but for the present is pushed to one end of the girders, a 30-ton 3-motor traveller having taken its place.

The next most important piece of machinery requiring power is the cupola blower. Particulars of a blower with 18-in. delivery, which is one out of several the writer has converted from steam or gas to electric driving, may be interesting. The most suitable motor for this purpose is the variable-speed shunt-wound motor with about 3 to 1 variation on the field. The cupola to which this blower was attached was capable of melting 10 tons of metal per hour. When the cupola was empty, and the blower running at its minimum speed, the load was 8 amperes. After the cupola was charged, and the blast applied, the load at its minimum speed (138 R.P.M.) was 15 amperes. From this point the speed was increased to its maximum, 190 R.P.M., and the current went up to 35 amperes. An hour later, at the same speed, the current had reached 40 amperes. Nearly at the finish of melting the blower was run at 138 R.P.M., the ammeter showing 20 amperes, and at 160 R.P.M., 30 amperes. The rising load without increasing speed is due to the molten mass inside the cupola solidifying and increasing the resistance to the passage of the blast at the tuyeres. A few days' blowing showed that it was uneconomical to run the blower at its maximum speed continuously throughout the whole period of melting, as no perceptible increase of metal was obtained by doing so. An automatic shunt regulator fixed so that the blast operated a piston inside a cylinder, and moved the sliding contact over the studs, gave economical results. The pressure of supply was 460 volts, and during a period of 13·25 hours' running the consumption registered on an ampere-hour meter was 162 Board of Trade units. A 30-H.P. motor was used.

Another small cupola blower, with a 10-in. delivery, was driven by motor with armature regulation. This example will serve to show the efficiency of shunt regulation as compared with armature regulation. With resistance in the armature circuit and a given position of the contact arm of the rheostat, the speed will vary according to the current consumed—that is, in proportion to the torque. In the case under observation the blower was required to run at 84 R.P.M. at the commencement of melting, the rheostat position being left to give this speed. The current taken was 12 amperes. After four hours' running, and as the contents of the cupola became more solid, the current gradually went up to 25 amperes, and remained there for some time. After another two hours' running the conditions became considerably worse, as a slower speed was required, because the quantity of metal the furnace was yielding was not wanted. This reduction of speed rushed the current up to 35 amperes. The Board of Trade units consumed for 10 hours' running were 57. The same blower was afterwards equipped with a variable speed motor. The shunt regulator was adjusted to give the blower approximately the same speed as with armature regulation. The current at the commencement of blowing was 5 amperes, and four hours later it had reached 8 amperes, with fixed rheostat position. Further particulars of varying speeds and loads were not recorded, but the consumption for 10 hours' running was 36 units. A 15-H.P. motor was used for driving the blower.

The following particulars relate to a loam mill converted by the writer from steam to electricity. The mill had a 7-ft. pan, top driven, with ball-bearing footstep. The top shaft was run at 110 R.P.M., which gave a speed to the pan of 22 R.P.M. The motor, shunt-wound, had an actual speed of 912 R.P.M., and was capable of developing 8 H.P. continuously, with overloads up to 10 H.P. without sparking. To drive the mill empty the current varied from 7 to 10 amperes. With red rock, horse manure, and melting coke wet, and the pan half full, the current was at first 15 amperes, and gradually fell off to 8 amperes. When grinding core sand, which is the same mixture but dry, the load remained constant at 18 amperes. When grinding wet ganister for cupola lining the load was constant at 20 amperes.

There are sundry other machines requiring power. The two tumblers and three emery wheels in the fettling shop of one foundry which the writer installed required 10 H.P. The tup for breaking scrap, with high lifting speed, required 8 H.P., and had a half-hour rated series-wound motor. The hook was weighted and the winch thrown out of gear with a clutch, so that it was not necessary to reverse the motor. A foot brake was used to sustain the load. Two other tups were provided with reversible series-wound motors, electric brakes and reversing switches.

There are several ways of loading up the cupola ; the most usual seems to be a hoist capable of elevating the raw material to a platform built round the charging hole of the cupola, where one or two men are kept at work charging by hand ; then one sometimes sees an inclined railroad from the floor to the bottom of the charging hole, on which an iron wagon is hauled up by a winch.

The writer recalls one particular hoist which he equipped with an electric motor, that had beenp reviously operated by a vertical steam cylinder. The cage was drawn up and down in four angle-iron guides by steam admitted to the cylinder. A small iron wagon was run into the cage and made secure, and when opposite the charging hole the cage bottom was tilted by a hand lever, thus shooting the contents into the fire. An ordinary winch, fitted with a reversible series-wound motor and electric series brake, replaced the steam cylinder. Push-button control was adopted, with limit switches top and bottom. The hand lever for tilting was reserved.

Of course a certain amount of manual labour is necessary for loading the cupola. Various mixtures of metal are required ; different brands of pig and scrap are used, and melting coke and limestone accompany these to the fire. Then we have the unloading of railway trucks and other vehicles that come into the yard, the stacking of pig and scrap and other raw materials, and the dispatching of finished goods. To meet the full requirements of the melting department, no single piece of lifting or conveying machinery could be called to the task, and it is only after full consideration of the individual circumstances that a really suitable selection can be made. The new transporter with high lifting and traversing speeds may, sooner or later, take up a useful position in this particular department.

IRRIGATION BY PUMPING IN AUSTRALIA.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.Inst.E.E.

During the writer's recent stay in Australia, he found that certain parts of New South Wales presented geological features similar to those of the fruit-growing areas of California—that is to say, they have a water-bearing gravel underlying good soil some 40 ft. or more in depth. Wells sunk through this soil into the gravel give a constant supply of good drinking water, but such water has, of course, to be pumped to the surface.

The writer specially mentions that it is a pure water, because practically all artesian waters in Australia are heavily mineralised, and, therefore, are of little use for irrigation. About 18 months ago Government Engineer Simmonds put forward a scheme for neutralising the salts with acid, but although it looked well on paper, the trials were not successful.

The writer is, therefore, of opinion that mineralised artesian waters will continue to be useless for irrigation purposes, and that only surface water conserved in the valleys of mountainous Australia or the water from underlying gravels can be depended on for the purpose. There are some fresh-water rivers, of course, but they do not count for much, because they shrink away during the droughty summers when water is most required.

The configuration of the mountainous region of Australia is unique from the point of view of conservation of water. Large valleys open out into the plain country, through narrow gorges which can be easily dammed up. The New South Wales Government is at the present time building such a dam across a valley at Barren Jack, and the writer was joint engineer with Messrs. Coane, of Melbourne, in a similar project at Trawool in Victoria.

Of course, dams can only be used for irrigating by gravitation, and the land served lies near to the mountains, where dams must necessarily be situated. It would be a pretty bad outlook for Australia if there were no other means of irrigation suitable for the other parts of the country ; the writer believes, however, that the water-bearing gravels can be used, as is done in California.

As stated, there are districts where such water gravels do exist ; indeed, the geologists state that a sort of underground river runs north from New South Wales across Queensland, and empties itself into the Gulf of Carpentaria. There is certainly a large discrepancy between the rainfall and the visible discharge of the various streams.

The writer believes that the time is ripe for carrying out a scheme of pumping on a large scale. The method employed in California is to sink wells about a mile apart, and install in them centrifugal pumps driven by three-phase motors. The motors are above ground, and connect with the pumps by means of vertical shafts. About 30 H.P. is the usual size, and where necessary the motors can be fitted with automatic float control. The pumps are supplied from the 1,000 odd miles of high-tension lines, which traverse the country in all directions.

Some years ago the writer joined, with Mr. McKinney, late engineer of the water supply in New South Wales, in an attempt to start such a scheme. The experience then gained showed that it could only be done profitably by acquiring a large area of ground at its present "sheep-country" value, and selling off portions as soon as the land had appreciated in value as the result of pumping operations. In this way the appreciated value of the land could be used to pay off the cost of installing the pumps, laying down a power station and transmission lines, &c.

It is just possible that electric power will be generated at the conservation dams, on lines first set out in detail by the writer and Messrs. Coane, in connection with Trawool Dam. Such electric power could be transmitted to areas beyond the reach of the gravitation channels, and thus the irrigation area could be very largely extended. Australia sadly wants men with ideas such as these, and financiers and engineers of determination to carry them out.

TAXATION OF EMPLOYERS IN RESPECT OF WAGES PAID.

The subject of the taxation of employers on the basis of the wages paid to their workmen was discussed by Herr W. von Siemens in a recent issue of the *Deutsche Revue*, in connection with the electricity tax proposed, but now rejected, as one of the methods for meeting the increased financial requirements of Germany. Apparently the scheme suggested by the author was intended as an alternative to the electricity tax, and one which should be borne by all employers of labour. The proposal, in brief, is that a certain percentage of all amounts paid as salaries and wages should be imposed as a tax upon employers, the question being left undecided whether the percentage should be uniform or graduated. If the suggestion was adopted, every employer would be called upon to pay as an Imperial tax an amount corresponding to the number or payment of the workers employed by him, ranging from a servant girl up to thousands of employés and officials. The scheme met with considerable opposition at the hands of the newspapers, which contended that the outlay on wages forms no measure of the economic capacity of an industrial undertaking, that it is by no means proportionate to the production, that it is independent of the employer's capital, and that a tax based upon it would place a burden specially upon the middle classes.

Herr W. von Siemens, who has now published a reply to his critics, expresses the opinion that the tax on employers is not to be recommended in itself and absolutely, but only as a lesser evil which would be preferable to many of the projects which have been under consideration. It is admitted that the proposal is not faultless. Its principal foundation lies in the idea that the State could claim the tax as an equivalent for the guarantees which it offers to its subjects, as, for instance, in regard to the Imperial expenses, which serve the interests of national economy, and the army and navy which support economic aspirations. But what the State performs for the individual is not measured by his net profits, which are already drawn upon by the income-tax, and not by the turnover, as the difference between the transactions of a bank and those of a works is represented by extraordinarily large sums. The performance of the State is perhaps indicated by the economic apparatus which is set in motion, and this measures the expenses on wages with sufficient approximation. At the same time, this outlay on wages, if it is considered that the material products often pass through a number of different industrial establishments, represents the greatest portion of the value of the total production. The proposal has the further advantage that it is to be determined simply and unequivocally, and that the total of all individual wages outlays simultaneously constitutes the wages expenses of the whole.

The outlay on wages, the author proceeds to remark, not only affords information as to the importance of the establishment, but the

expenditure incurred by the empire in the interests of national economy is also connected principally with the from 15 to 20 million men and their dependents who receive the wages. It has been considered unjust that the wages outlay is by no means proportionate to the value of the product in various establishments, and that it should yet form the measure for taxation. An engineering works, for instance, pays about 30 per cent. in wages, whereas a contractor for earthworks pays about 80 per cent. Herr von Siemens admits that this is correct, but he points out that, whilst the contractor moves earth principally in connection with his establishment, the engineering firm utilises raw materials upon which wages have been already expended in other works. The earthworks contract must consequently be compared with all the works through which the engineering manufacture has passed. As far as concerns the placing of a burden upon the middle classes, it is submitted that in general it can, perhaps, not be avoided, that these classes always have to bear the larger portion of the State burdens, although the employers' tax in particular has at least the preference of leaving free from tax the small artisans and the peasants who do not employ paid workers, but are assisted by their families.

A Berlin newspaper had given expression to the apprehension that employers would transfer the wages tax to the workers. The author, however, states that in this respect the employers' tax would stand just as every other tax which the employers pay, and in particular just as the expenses for social matters which they already pay for the workers. Employers would be just as little able or willing to transfer the one as the other. But the probability exists that the wages tax would act as an incentive to the endeavour now being made everywhere to reduce the cost of production. If it is wished to compare the proposal with another, the projected coal tax and property tax first come into consideration. In any case, the proposal would be less embarrassing to industrial establishments than a tax on coal. If a certain estate produced a value of £7,500 per annum and paid £1,500 in wages, an employers' tax of 1 per cent. would be equal to £15, which would, presumably, be easier to bear than the levying of a tax from time to time on the portable and fixed property. In conclusion, the author submits that the workman would prefer his employer to tax the wages with 1 per cent., rather than that his luxuries, fuel, and perhaps his food, should be rendered more costly.

PORCELAIN AS AN INSULATOR.

Porcelain is probably the material which at the present day most closely approaches the qualities of a perfect insulator as regards high breakdown voltage, low water absorbing power, fire resisting power, permanence of form and quality, and mechanical strength, although it fails somewhat in regard to the last point. This failure is, however, more due to its brittleness and inelasticity than to actual want of mechanical strength in that material.

Porcelain, like other artificial insulators, varies largely in quality according to the processes and materials employed in its manufacture, and Dr. A. Zoellner, in a recent number of the *E.T.Z.*, gives a *résumé* of some valuable tests carried out by him on these points. The porcelain used for insulating purposes is "hard porcelain," which consists of a mixture of felspar, quartz, and kaolin. The most important constituent is kaolin, which, in its

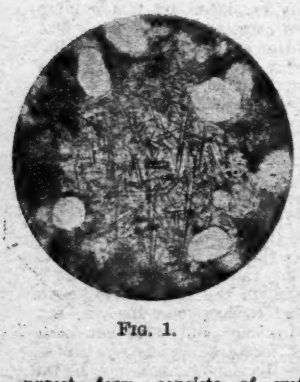


Fig. 1.

Fig. 2.

purest form, consists of water and an aluminium silicate ($Al_2O_3\ 2\ SiO_2\ 2\ H_2O$), and is distinguished by great plasticity, contractibility, and power to withstand heat. If kaolin alone is burnt in the furnace, a hard white product results, which, on account of its great porosity, is useless as an insulator, but is much employed in electrolytic work.

The felspar when heated to over 1,200° C. results in a glass which, owing to the presence of numerous minute air bubbles, has a milky appearance. If heated above its melting point this material has the power of partially decomposing quartz and forming a homogeneous flux with it. The glazing on the porcelain is, in fact, nothing but a glass flux formed out of the porcelain by the addition of other fluxes such as felspar, chalk and magnesia. The process of porcelain manufacture is as follows:—In the first furnace process, at a temperature of 700° C. to 800° C., the kaolin loses its water and contracts, and sinters together considerably; the quartz from 500° C. onwards expands somewhat, and so counteracts the contraction of the kaolin to a certain extent; the felspar remains unchanged. The resulting product is very fragile and hygroscopic. The whole is then dipped in the glazing solution and subjected to a second heating in a furnace at 1,400° C. to 1,450° C. The height of this temperature, however, varies considerably in different factories. When about 1,200° C. is reached, the felspar melts and soaks through the pores of the base material and binds it. With further heating some of the quartz and kaolin is decomposed.

At about 1,370° C. or 1,400° C. the whole material becomes unstable and appears about to collapse, when suddenly a characteristic chemical change occurs. The material splits up into two components, one of which is a glass-like silicate, and the other a crystalline silicate of the composition $Al_2Si\ O_5$. At this instant the mass is in a tough dough-like state, and innumerable fine needle-shaped crystals form in the body of the material in all directions. These crystals give strength, and enable the object to retain its shape.

If a sufficient temperature for this important change is not reached, a porcelain of low value results, which is characterised by a dry, granular fracture. The fully formed, high-temperature porcelain, on the other hand, has a glossy shell-like fracture, and shows a bluish white transparency in small thicknesses. Fig. 1 shows a section magnified 180 times of a piece of porcelain stoved at 1,450° C. The fine crystals, crossing in all directions and embedded in a glass-like mass, are clearly seen, as well as the round and oval air bubbles. Fig. 2 shows a similar section at the junction of the glazing and the body material, and indicates the intimate mixing of the two.

The author's tests point clearly to the value of the last 100° C. of the stoving temperature. Thus, in certain insulators intended for 40,000 volts, a lowering of the breakdown voltage by as much as 10,000 volts was found in material not raised to the crystallising temperature as compared with that found in the properly stoved porcelain.

Another point of great importance is the presence of air bubbles both in the glazing and in the mass of the porcelain. Glow and brush discharges over the surface of dry insulators occur only because of the presence of these bubbles. Complete breakdown then follows through the enlargement of the bubbles and the breaking down of the intermediate walls. An actual melting of the mass at the point of breakdown has also been noticed.

Further experiment must decide how far the presence of air bubbles can be avoided, and also precisely what chemical composition leads to the most serviceable grade of porcelain.

PROCEEDINGS OF INSTITUTIONS.

On Testing the Insulation Resistance of Live Cables on Direct-Current Systems.

By R. G. Allen, B.Sc.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Dublin, March 11th*, 1909.)

The chief advantages of working with the *live* cable rather than the *dead* cable when testing its insulation with a Kelvin or similar set are as follows:—

1. The battery is dispensed with.
2. The insulation resistance of the cable is determined at *working* pressure.
3. The insulation resistance of *each* cable in a circuit can be determined by the method to be given. When tested as a dead circuit in the ordinary way, by using a battery, the only possible determination is the value of the multiple arc formed of the two insulation resistances of the cables.

The circuit shown in fig. 1 is supposed to be one of the sections fed from the main cables M_1 and M_2. A and B are connections from

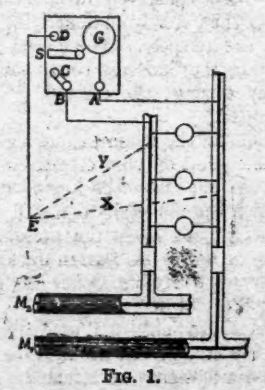


Fig. 1.

the cables to the two terminals of the testing set ordinarily used for the battery. The terminal D is earthed. The insulation resistances X and Y of the cables are represented by the dotted lines. The test is conducted thus:—

1. With G suitably shunted, place S on C and read the deflection. Multiply the latter by the shunt value used and call this number D_1.

2. Repeat a like operation with S on D and so obtain D_2.

3. Leaving S on D, *interchange* the positions of the ends A and B and find D_3 in the same way as D_2.

Then the insulation resistance X of the right-hand cable and Y for the left-hand cable are given by the relations—

$$X = \frac{D_1 - (D_2 + D_3)}{D_3} \cdot G; \qquad Y = \frac{D_1 - (D_2 + D_3)}{D_2} \cdot G.$$

These values for X and Y are readily proved. Fig. 2 shows the arrangement of the circuits in each of the three operations of the test.

The application of this method to such a system as that shown in fig. 3 gives the means of determining—

1. The insulation resistance of each of the main cables.

2. The insulation resistance of each cable in the different sections fed by the main cables.

The first determination is made as just described, after cutting out all the sections and connecting the testing set to the live mains at points such as A and B. The second determination—namely, to find the insulation resistance of each of the cables of any given section fed by the mains—is made in the same way. In this case

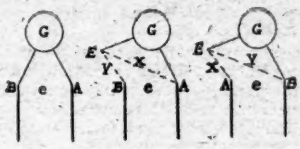


Fig. 2.

the test can be performed without interfering in any way with the working of the system. To test, for instance, the second section shown in fig. 3, all that is necessary is to connect this section to the testing set in the same manner as shown in fig. 1, and proceed by the method described in connection with that figure.

Each cable in the whole system can, therefore, have its insulation resistance at the working voltage tested and registered, and any cable defective in insulation resistance will be at once identified.

The limiting potential difference of the cables for the application of this method will depend on the construction of the testing set. With the Kelvin set the method can be applied—assuming all the usual precautions are taken when dealing with high voltages—up to a P.D. of 400 to 500 volts.

In the exceptional case of cables of higher potential difference than usual, the only alteration required in the method is shown in fig. 4. A suitable high resistance is placed between the cables, and a fraction of the whole potential difference is used to give the deflection in the *first* operation of the test. The two remaining

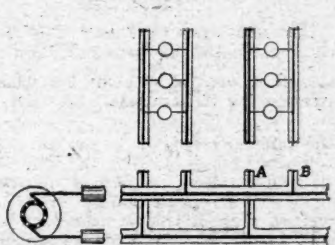


Fig. 3.

operations are unaffected if the end K from B is removed after the first operation to the end *a* of the left-hand cable. The true value of D_1 will now be the deflection of G multiplied by the shunt used and further multiplied by the whole of the high resistance divided by the part used to furnish the necessary voltage in the first operation. D_2 and D_3 will be determined as already shown, with the end K at the end of the left-hand cable.

So far, the insulation resistance of each of the two cables of a circuit such as that in fig. 1 has been determined. There is a third insulation resistance in connection with this circuit which should also be tested—that between the cables. This may be performed in the following manner:—First switch off all the lamps in this section, and then make connections to the testing set as shown in fig. 5. The galvanometer G will now act as a sensitive ammeter—reading, if necessary, to a value as low as $\frac{1}{100}$ of a milliampere. It can be used to read up to several amperes if the galvanometer be shunted at the battery terminals of the testing set with a suitable external resistance. X and Y are supposed determined by the previous method. Let S represent X + Y, and Z be the insulation resistance between the cables to be determined. Then, if D is the deflection of G suitably shunted—

$$\frac{E}{G + \frac{ZS}{Z+S}} = k\,D \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

E being the potential difference between the mains measured by a voltmeter. Now remove the ends *a* and *b* and connect them to a few storage cells of voltage E_0. Then, leaving the same shunt on G as before, read the deflection D_0—

$$E_0/G = k\,D_0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

From (1) and (2) and the values found for X and Y the value of Z can be easily found. Hence for any given section the insulation resistance of each cable with respect to the earth can be found, and also the insulation resistance between the two cables.

It will now be advisable to consider the cases of *main* cables, in which the outgoing and return conductors form one cable.

In the case of twin cables the test is made as already described.

In the case of concentric cables (fig. 6), Z will be determined by the method used in connection with fig. 5, with all the attached sections cut out. X, the insulation resistance between the outer conductor and the earth, can be found by disconnecting the *inner* conductor from its terminal at the dynamo and joining this terminal to the testing set—to be used as an ammeter—and connecting the other end of the set to earth. Then, if E is the terminal P.D. of the dynamo—

$$E/(X + G) = k\,D.$$

Now join the galvanometer to a few storage cells of voltage E_0, as described before, and obtain the deflection D_0.

From these two equations X is readily found.

In the three-wire system of figs. 7 and 8, Y, the insulation resistance between conductors 2 and 3, may be obtained by the method used in connection with fig. 5. In this determination all the attached

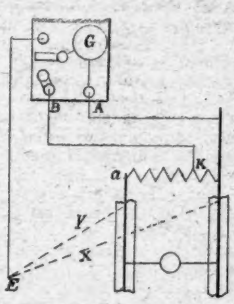


Fig. 4.

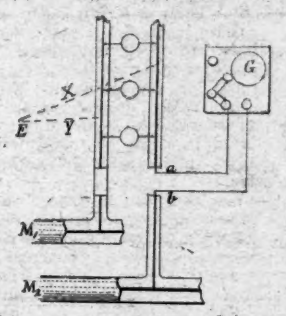
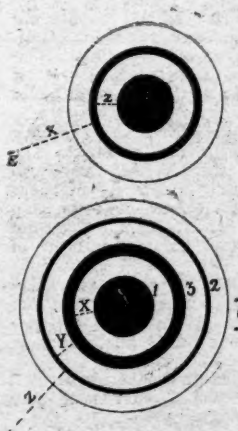


Fig. 5.

sections between conductors 1 and 2 and 3 as well as the dynamo B are cut out, and connection is made to the galvanometer as shown. The galvanometer of the testing set, used as an ammeter as already explained, gives the current going through the resistance G + Y, and this current equals E/(G + Y), E being the terminal potential difference of dynamo A. From this relation, as explained before, Y can be found. X, the insulation resistance between conductors 3 and 1, can be determined by the same method. In this case conductor 2 must be disconnected from *O* and all the attached sections cut out as before. The connections to the galvanometer will be the same as in the preceding determination. In this test the potential difference will be the terminal value for the dynamos in series. Z, the insulation resistance of the outer cable from earth, can be found in the same way as X was in the case of the two concentric



Figs. 6 and 7.

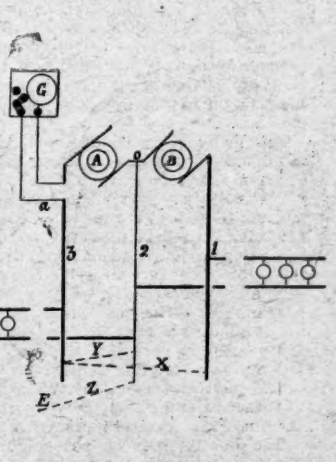


Fig. 8.

conductors mentioned at the end of the last paragraph. In this test the dynamo B and all the sections of the system must be cut out, conductor 3 must be disconnected from *a*, and *a* joined to earth. Conductor 2 is supposed to be in position, that is, joined to *O*. The readings of G are then taken and the value of Z is found. It is hardly necessary to add that the test of the cables is quite independent of the state of the insulation of the machines.

It will be understood that, though the tests for the insulation resistances of the *main* cables require the cutting out of the sections and sometimes one of the machines during the test, yet the test for

each section fed by these mains may be determined without interfering in any way with the working of the system. The method of this paper lends itself readily to the case where an accurate registration of the insulation resistances of the *main* cables of a direct current system is desired immediately after laying down. As stated before, the test of a section fed from the mains can be performed without interfering with the working of the system.

Notes on Safety of Working Electrical Plants in Coal Mines.

By Sidney A. Simon, B.A., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Glasgow, March 29th*, 1909.)

It is a noteworthy fact that there has been a remarkably small number of serious electrical accidents in mines involving loss of life or injury to persons or property; and particularly, no accidents have occurred which have occasioned explosion of firedamp or coal dust.

There is, in consequence, no indication by actual experience as to which of the variety of protective designs which have been utilised, may be less safe and more likely to cause a disaster.

Rule 37 (Sec. V., Motors) only provides for the enclosure of all current-carrying parts of motors, switches, starters and accessories in flame-tight non-inflammable enclosures of sufficient strength to resist the effects of an explosion in the interior, in all locations under Class 1, unless the place in question is a room separately ventilated with intake air.

It would, therefore, appear that, according to these rules, in all locations under Class 2, as well as locations under Class 1, which can be separately ventilated with intake air, no special protective devices are called for except such as would be dictated by common sense or ordinary engineering experience to comply with the local conditions obtaining in similar locations in any other branch of industry.

The motors should be placed in well-built chambers, properly lighted and ventilated with intake air, where there is less likelihood of water dripping from the roof, and where there is light for inspection and room to give access to all the working parts of the motor, and to which, by being as far as possible shut off from the main roadways, there is less liability for the penetration of coal dust. Such chambers can easily be kept clean, and the writer has seen many of them in Continental mines, which, with their arched roofs and spotless tiled pavements, it was difficult to conceive were 600 or 700 yards below the surface of the ground. In such chambers no special protective device would be required, but standard machines would meet all requirements.

If it is impossible to avoid dripping or spraying water, it is necessary to have recourse to enclosing covers, which should be of the weatherproof ventilating pattern, designed so as to interfere as little as possible with the cooling of the motor. The covers, however, should be opened readily to admit of frequent examination of the windings with a view to preventing accumulation of coal dust. There is a practical difficulty in the regular inspection, examination, and cleaning of a motor with enclosing covers of any kind, in the negligence or carelessness of the average attendant, who will not take the trouble to open up his motor every day for the purpose, whereas it is not nearly so difficult to get him to clean up and blow out an open-type motor regularly—first, because there is less trouble involved; and, secondly, because the inspecting official is more likely to notice any default on his daily rounds.

Article 38 (Sec. V, Motors) provides that in any place where General Rule No. 8 applies, a reliable apparatus for the detection of firedamp shall be provided, and immediately an indication of firedamp appears the person in charge of the machine shall at once cut off the current and report the matter to an official of the mine.

This, no doubt, would also apply to special chambers separately ventilated with intake air when located in such a district. The question therefore arises whether the motor should also be provided with any special protection as a further precautionary measure to prevent danger in the case of the presence of firedamp not being noticed soon enough, and in consequence, the motor not being stopped in accordance with the rule. In general, I am of the opinion that such measures are not necessary. The provision of totally enclosing so-called flame or explosion-proof covers would appear to be *entirely unnecessary* as a precautionary measure, it is not at all certain that such covers form an absolutely sure protection, and by providing them one would create a false sense of security which might lead to very grave consequences.

The question, therefore, resolves itself into whether or not it is necessary to enclose any current-bearing moving contacts at which there is a likelihood of sparking occurring in service.

The probability is that the majority of such motors would be of the induction type; those working on continuous service would, if of the slip-ring type, in all probability be provided with devices for short-circuiting the rotating windings and lifting the brushes, so that the moving contacts would only be in use for a short period of time when starting up. Such motors undoubtedly do not require enclosures of any sort, as an attendant could always avoid starting the motor if firedamp were present. Motors which require frequent stopping, starting, or speed regulation, however, would not be provided with short-circuiting and brush-raising devices, and there would be a likelihood of sparking occurring the whole time they were in service. Even for such cases, however, no hard-and-fast rule for enclosing can obtain. The advisability of enclosing such slip-rings would depend on local conditions, which determine the degree of possibility or probability of the unexpected presence of firedamp in the chambers.

For all motors with their apparatus and accessories located in positions where General Rule 8 applies, and which are not in chambers separately ventilated with intake air, the rules call for total enclosure.

Experiments were carried out for the purpose of determing the value of totally enclosing as a protection against explosion, at the time of the special committee on the use of electricity in mines, and exhaustive experiments with the same object were commenced on the Continent about the same time, the results of which confirm those arrived at by the special committee.

The trials in question were carried out conjointly by six of the leading electrical engineering firms in Germany, and the committee of the Westphalian Mining Fund.

The tests of 1903 showed that practically all the protective devices fitted to motors as proposed were either insecure and a positive danger in an explosive atmosphere, or ineffectual for mechanical or electrical reasons. It was found practically impossible to prevent the entrance of explosive mixture into the interior, especially if the motor were frequently started and stopped, with consequent alternate heating and cooling of the enclosed gases. If sparking occurred in the service of these motors, an internal explosion occurred, which generally either blew the enclosing covers off, otherwise damaged the motor casing, or expelled flames and ignited gases through the bearings and oil wells, thus in most cases communicating the explosion to the surrounding atmosphere. It was found, however, that if gaps were provided of a certain size, *i.e.*, not so small as to prevent the egress of the heated gases and cause a dangerous rise of pressure, and not so large as to allow free passage of the burning gases, the communication of the explosion was avoided.

Covering the openings with wire gauze (even with two layers) was not found altogether satisfactory. The continued combustion inside the motor of firedamp after the first explosion had ignited it, raised the gauze to a very high temperature and destroyed it, and an explosion took place. A further disadvantage of this class of motor is the very small amount of ventilation that the fine-meshed gauze permits.

In the case of slip-ring motors the immersion of the rings in oil was found impossible.

Further experiments were undertaken in 1904. Observations were made on the extent to which the nature of the explosion was modified by introducing partitions with orifices and other obstacles.

In the case of two vessels communicating with one another through a small aperture, if ignition takes place in one of the two vessels, the pressure in the second may rise to as much as 12 atmospheres.

Owing to the difficulties of building motors and other electrical apparatus actually gas-tight, *i.e.*, in which there is no communication between the inside and the surrounding atmosphere, and the observed fact that an explosion can take place in a box with a badly fitting lid without communicating itself to the surrounding atmosphere, a series of experiments was undertaken with a view of studying this phenomenon. The results of these experiments may be summarised as follows:—

1. The maximum pressure developed in a vessel of moderate capacity by an explosion of accumulated firedamp is about 6·5 atmospheres. If in the inside of the vessel small portions are divided off by internal objects, and the compartments thus formed communicate with one another through comparatively long and tortuous passages, some portion of the enclosure may be exposed to a pressure of eight atmospheres. Moreover, if the interior is partitioned off into large spaces communicating with one another through small apertures, according to the size and number of these compartments, internal pressure may be developed which no practicable method of enclosure can be made to resist. In mines of very great depth the internal pressure is proportionally higher.

2. Small openings, such as narrow gaps or fine slits in the enclosure, are not dangerous. The larger the area of opening, the less effective is the enclosure, and especially so if the aperture does not expose cooling surfaces to the gas in its passage through it. Moreover, it is less effective the nearer the point of ignition is to the aperture, and the danger increases inversely with the explosiveness of the gas. An enclosure which is not gas-tight, or one with openings, is generally safe if the pressure of the ignited gas rises to 1·1 atmosphere or more before flames are expelled.

It was further found on extending these experiments to motors that the rotation of the rotors modified considerably the effects produced. The rotation appeared to increase the pressure and rapidity of the explosion. Although an enclosing cover with apertures in it may, under certain circumstances, be an effective protection, it cannot be relied on in every case, as its efficacy depends on the composition of the gas, the position of the point of ignition relatively to the aperture, and to the state of motion of the rotating parts—all of which, and particularly the last factor, may influence the effect of an explosion in a manner which cannot be determined *a priori*. Under the most favourable circumstances, moreover, the maximum safe area of the openings is small, so that a motor would have to be designed practically with the characteristics of a totally enclosed motor.

Experiments were carried out to test the efficacy of steel, copper, and brass wire gauze, having 144 square openings to the square centimetre, with wires 0·35 mm. diameter, in which the openings cover about one-third of the total area—practically the same dimensions as employed in the safety lamp.

By increasing the number of layers the ventilation is seriously impaired, while a single layer is very liable to mechanical injury. Even a hole in the gauze, caused by the removal of the little cross between four holes, was found to be sufficient to impair its efficacy

and cause an explosion. One of the greatest disadvantages of gauze protection was found to be the "burning" mentioned before.

From the observed fact that slits or gaps of not more than 0·5 mm. width and about 50 mm. depth are not sources of danger, finally a form of protection was devised which embraces all the advantages of gauze without its defects. It is the so-called "plate" protection. It possesses mechanical strength, permits of ventilation, prevents an explosion by cooling the issuing gases, and is not damaged by after burning should this phenomenon take place. It consists of a series of plates, usually ½ mm. thick and 50 mm. deep, placed side by side at a distance of ½ mm. from one another in openings of the motor or apparatus casing. These plates are usually in the form of rings or hollow squares, but they can be any shape or size. Any number can be used, according to the amount of ventilation required, and the protection secured is independent of the position of the point of ignition, the relative volume of the containing vessel to the area of opening and of the composition of the gas.

Summarising, of all the various methods proposed as protective devices, the use of a labyrinth enclosure, an enclosure pierced with pipes, and the so-called flange enclosure are totally unreliable as protective devices, and must be rejected as unsafe.

On the other hand, the complete enclosure, the enclosure in wire gauze and the "plate" protection, afford reliable methods of protection, and can safely be adopted when suitably applied. To these must be added oil immersion.

Total enclosure is mainly available in cases where internal ventilation is not essential in order to carry off the heat generated in the apparatus. Apparatus or machinery in which heat is generated is, generally speaking, not suited to this method of protection. In order to be effective, the complete enclosure has to be made very strong indeed, entailing considerable weight and initial cost. This method of enclosure is therefore mainly applicable to switch-gear, junction boxes, and very small motors.

Protection by means of wire gauze permits of ventilation, and in this respect affords an advantage over a total enclosure. Wire gauze, however—which must be doubled to be safe—is very liable to mechanical injury, and must, therefore, be further protected by a mechanical safeguard.

Plate protection affords ample ventilation, and at the same time sound mechanical protection, and should, therefore, be considered as the most suitable enclosure for all motors.

Protection by oil immersion is mainly applicable to switchgear in which sparking would otherwise occur in the ordinary course of service. It can with advantage be combined with plate or gauze protection.

In applying any of the methods of enclosing above mentioned, particular care should be exercised in the design of the machinery or apparatus to prevent any communication between large spaces through passages or apertures, where such communicating spaces might give rise to the development of exceedingly high internal pressure in case of an explosion occurring.

Discussion.

Mr. Sam Mavor said that they ought to have more guidance from the Home Office with regard to rendering motors as safe as possible when surrounded by explosive gas. With regard to the importance of isolating chambers from each other, he had made a practice of hermetically sealing between switch and fuse boxes, because it seemed to him that the smaller the volume of contained gas, the less risk there was of bursting the box. An extremely important point was the necessary ratio of area of vent to the volumetric capacity of the containing vessel, and he would be glad of information on this point. He had for some time used gauze protection. So far as coal-cutting machinery was concerned, the difficulties were very acute, as the coal-cutter was used at faces where out-bursts of gas were liable to happen. The danger was somewhat alleviated by the fact that such a machine was generally in charge of a man who knew how to stop it whenever the safety lamp showed the presence of gas, until such time as the ventilation had been improved. An explosion in a motor might take place, and a flame find egress and not ignite the surrounding gas.

Mr. Halley Craig pointed out that a great many machines had been designed for use in mines without any regard to the principles enumerated by the author of the paper.

Mr. Stevenson was sorry Mr. Simon had not dealt with the question of cables in connection with which there were as many difficulties as with the plant proper. He referred to a type of motor with a fan inside for drawing air by a pipe from the downcast shaft; and with regard to the special plate protection, he asked as to the effect of the plates on the rating of the motor. He thought the whole paper supported his views with regard to the use of squirrel-cage and slip-ring motors for mines in preference to machines with brushes and contacts. He believed the only safe type of switch was the oil-break switch.

Mr. Clothier thought the author too sanguine, for only a few weeks ago an accident happened in an English mine, where two men lost their lives, and according to evidence the flame then emitted was from the switch which had been provided with what had been considered a flame-proof water-tight joint. In order to obviate such dangers, it had been the custom of his firm to use a wide-flanged joint on all switches having an air break. This joint was so machined that it had a good wide metal bar surface. This was clamped down by a number of bolts, and if it was not clamped down tight they had what was tantamount to plate protection; a number of slits were left between metal faces. Mr. Simon had pointed out the difficulty of making electrical machinery gastight, as they had to have spindles projecting through and switches had to be made to operate mechanically. It was generally considered that the very rapid break obtained by the use of oil was likely to give rise to abnormal voltages, which might hurt the insulation. This might not apply to alternating currents. He did not agree that oil gave a sure protection. He did not like plate protection, because coal dust got in through the slits, and therefore, for switch accessories, he favoured total enclosure.

Mr. Kessoll considered gauze a good protection, if strong enough.

Mr. Robertson said he had recently found some of the colliery plant particularly adapted for use in shipyards.

Mr. Mackenzie asked the writer to state his experience with coal dust choking up the openings in the plate protection.

In reply, Mr. Simon contended that the evidence in the recent explosion showed that it was due to carelessness. In dissembling the motor, he said, it was not necessary to remove the plate protection, as this was fixed inside the cover. So far as coal-cutting machinery was concerned, small motors were generally used, and the best protection was to make the casing strong enough to withstand such high pressures as might occur in case of an explosion inside. He considered the idea of a self-ventilated motor in a mine a good one, if it did not entail too much expense for piping. As to the effect of plate protection, a motor of 30 h.p. would have its output reduced to 24 h.p.; but, of course, if a motor were built specially with a bigger number of openings, the reduction might be less. The squirrel-cage motor might be used with advantage in the fiery parts of mines, but for haulage gear, where a certain minimum speed was required, this type of motor could not be used. Oil-break switches were not invariably safe. He had known cases where explosions had occurred in oil vessels, not on account of accumulated gas, but on account of the disposition of the oil, and therefore it was best, even where oil was used, to have the switchgear further enclosed either in a solid enclosure or in one provided with gauze or plate protection. The solid enclosure was better; it had not the possibility of being damaged by mechanical means. On the other hand, solid enclosures must be made very strong indeed. The use of oil for d.c. switches was certainly not so effective as for a.c., and should be avoided as far as possible. He thought that, as far as underground work was concerned, three-phase current was more advisable in collieries than continuous current. With regard to the choking of the plates with coal dust, he pointed out that it was in view of this that he had laid such special stress on periodical cleaning and putting the motor as far away as possible from dust. The cleaner the underground chamber, the better the chance was of the plant being kept in good order.

The Electrical State of the Upper Atmosphere.

A short paper was read before the Institution of Electrical Engineers at Manchester, on March 23rd, by W. Makower, Margaret White and E. Marsden, giving the results of an investigation made during July and August, 1908, and chiefly concerned with the measurement of the electric currents flowing from a kite down the wire by which it is attached to the winding machine. In the first experiments different lengths of wire were let out with the kite, detached from the winding machine and the free end of the wire attached to an ebonite insulator fixed to the ground. The kite was then connected to earth through a sensitive dead-beat galvanometer and the current measured. In these experiments the currents at considerable heights were so large that it was found necessary to reduce the sensitiveness of the galvanometer by shunting. The plan was, therefore, adopted in later experiments of using a portion of the kite wire when attached to the drum of the winding machine, which was earthed, as a shunt, and thus making use of the usual daily flights taking place at the Glossop Observatory. The mean currents obtained are given in the accompanying table:—

Height of kite above ground.	Current in amperes.
2,000 ft.	5×10^{-5}
4,000 ft.	13×10^{-5}
6,000 ft.	23×10^{-5}

The current at any fixed height varied considerably from day to day. There seemed, however, to be a fairly close connection between the current and wind velocity, the current being great when the wind was high. A few experiments have been made on the potential of the air at different heights, but no very reliable results have yet been obtained on account of the difficulty of satisfactorily insulating for the high potentials to be measured.

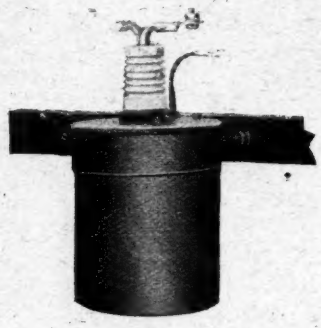
Charge of Threatening.—At Liverpool Police Court on Tuesday last week, Arthur Evans Kennedy, an electrical engineer, formerly in the employ of the Liverpool Corporation, was charged with threatening to kill Sir Charles Petrie, chairman of the Liverpool Tramways Committee. It was stated that Kennedy had been employed in the electric lighting department for some 12 years. It was found necessary in May, 1908, to suspend, but not discharge, a number of employés in that department, owing to slackness of work, and Kennedy was one of those who had to stand off. Subsequently he wrote a letter to Sir Charles Petrie, in which he said, "By God, I declare I will wipe you out! I will that!" There were also threats against Mr. Alfred Clough, resident electrical engineer, and Mr. James Witter, who had been prisoner's foreman. Kennedy was found guilty and bound over to keep the peace for 12 months, in his own recognisances of £500 and two sureties of £250 each.

CURRENT TRANSFORMERS FOR MEASURING INSTRUMENTS.

The essential features in the design of a first-class current transformer are:—Constancy of ratio over a wide range, with a high secondary output; small angle of phase displacement between primary and secondary; independence of frequency and wave form; high insulation, and freedom from breakdown; strong mechanical construction, and general facility for mounting.

We give below particulars of some of the various types of current transformers for switchboard use recently placed on the market by Messrs. Siemens Brothers & Co., Ltd. The curves which we reproduce in connection with these show that the transformers in question possess, in a very high degree, the essential electrical features mentioned above. We understand that these excellent characteristics are chiefly due to the use of a completely closed

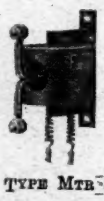
Type Mtr 1.



Type Mtr 2.

iron circuit. Each of the plates of which the core is built up is stamped out in one complete piece, thus avoiding all joints in the iron circuit; the coils are wound on the arms of the core, as required, by means of a specially designed machine. Greater uniformity in the manufactured article is also ensured by this method of construction, as the final result is not as dependent upon individual skill as it is in the case of transformers in which each core plate is formed of several pieces of sheet iron.

Of the various types illustrated, some have both primary and secondary windings, whilst others have only a secondary winding, the primary in this case being formed by the line conductor or bus-bar. Otherwise the types are distinguishable by various working pressures, P.D. at secondary terminals, different values of secondary current, &c.; Mtr 1, for instance, is constructed for a working pressure of 6,000 volts, is tested with 12,000, and has a breakdown pressure of 35,000 volts, the factor of safety, therefore, even when using the transformer at its highest rating, being nearly 6; a second model of this type is constructed for a working pressure of 12,000 volts, with test and breakdown pressures proportionately advanced. In both cases the highest permissible secondary output at which constancy of ratio is guaranteed varies according to the frequency of the circuit, being 7·5 volt-amperes (*i.e.*, secondary current of 5 amperes at P.D. 1·5 volts) at 50 periods and 4 volt-amperes (5 amperes × 0·8 volt) at 25 periods. The ratio of this type Mtr 1 is adjusted with an electromagnetic



Type Mtr 3.

Type Mtr 6.

Type Mtr 8.

ammeter as secondary load, whilst the Mtr 2 is adjusted with a secondary load of 5 amperes at 3 volts; the angle of phase displacement with this load (15 volt-amperes) is less than 25 minutes. In the case of type Mtr 2, the working pressure is 15,000 volts, test pressure 30,000, and breakdown pressure 60,000 volts. When using transformers in circuit with watt-metric instruments it is essential that the errors due to ratio and phase displacement, particularly the latter, should be negligible in order that the readings may not be affected. In view of a very prevalent misunderstanding on this point, it is well to point out that whilst it is quite possible to eliminate all errors of ratio by means of a combined calibration of the instrument with the transformer, it is not possible, in cases where the power factor of the supply system is of a variable nature, as is generally the case, to eliminate errors due to phase displacement. With the transformers under review the two errors mentioned, particularly that due to phase displacement, are so exceedingly small that the result of their influence is well within the scale error of the instrument, and they can be used on systems having a variable power factor, without the readings of the instruments to which they are connected being affected. The highest permissible secondary output of a type Mtr 2 current transformer in circuit with wattmeters under the conditions mentioned above is 20 volt-amps. at 50 periods, but if only current-measuring instruments or relays are being used this output may be raised to 60 volt-amps., and the accuracy of the ratio will still remain within 1 per cent. A second model Mtr 2s of this type, constructed for a higher secondary P.D., permits of a secondary output of 35 and 120 volt-amps. respectively. These values are, of course, not the heating limit of the transformer, as the maximum secondary load from this point of view is in the latter case 150 volt-amps., and in the case of Mtr 2, 100 volt-amps., and may even be increased considerably without damaging the transformer if the load is of an instantaneous nature, such as operating a trip-coil, &c. However, if it is intended to use the transformers for this class of load, a combined calibration of the transformers and instruments should be made (see fig. 11).

A study of the curves 6 to 11 will serve to demonstrate the accuracy of these current transformers at 50 periods. The ordinates in curves 6 to 10 give the error in per cent. of the actual readings,

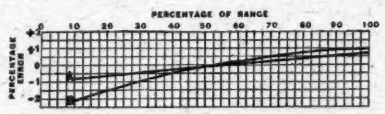


Fig. 6.

Type Mtr 1. Secondary load, A, electromagnetic ammeter; B, Ferraris ammeter.

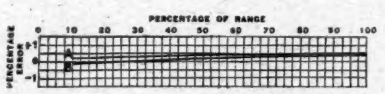


Fig. 7.

Type Mtr 2. Secondary load, A, electromagnetic ammeter; B, Ferraris ammeter.

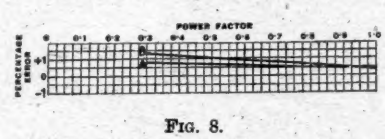


Fig. 8.

Types Mtr 2 and N 62 (for 10,000 volts). Secondary load, Ferraris ammeter and wattmeter. Curve A, maximum current; B, half current.

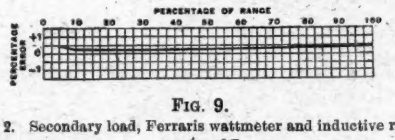


Fig. 9.

Type Mtr 2. Secondary load, Ferraris wattmeter and inductive resistance; $\cos \phi = 0{\cdot}7$.

Fig. 10.

Type Mtr 2. Secondary load, 5 amps. at 4 volts. Curve A, standard design; B, special design.

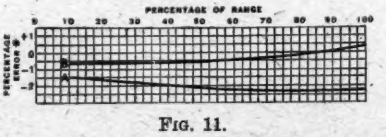


Fig. 11.

Type Mtr 2. Secondary load, 5 amps. at 22 volts. Curve A, independent calibration; curve B, combined calibration.
*Percentage of maximum value.

under the load conditions set forth in the curve, whilst in fig. 11 the error is shown as a percentage of the maximum value—the more usual method of giving these curve values. Curves 6, 7, 9, 10, 11 show the error as a function of the load, whilst 8 shows the relation between the power factor and the error. Fig. 9 demonstrates the behaviour of a type Mtr. 2 current transformer with a secondary load consisting of a Ferraris rotary field type induction wattmeter, or a recording instrument of similar type, with impedance = ·03 ohm, and a highly inductive resistance with impedance = ·35 ohm, and a power factor of 0·7. From the exceedingly small error it will be seen that, with such a power factor, the falling-off of the ratio at low loads is almost completely compensated for by the influence of the phase displacement error. The behaviour of a similar transformer under conditions of exceptionally high secondary loads (*e.g.*, 110 volt-amperes) is shown in fig. 11; for the purpose

of this test the secondary was formed by a relay-coil of high self-induction in series with an aperiodic ammeter, taking 5 amperes at about 22 volts, cos $\phi = 0{\cdot}12$; for curve A a standard transformer which had not been calibrated with the instruments was used, whilst the transformer and instruments used for curve B were subject to combined calibration. It is seen from these curves that, even with this high secondary output, the ammeter readings are only affected to the extent of $\pm$ 0·6 per cent. For cases where an unusually high degree of accuracy is required a special type of transformer has been designed; in general appearance and mechanical construction this type does not materially differ from the Mtr 2, but an examination of the curves will show that the maximum error is reduced from 0·8 to 0·1 per cent.

With regard to insulation, some of the types are air insulated, whilst others are insulated with a special compound which forms a point of particular interest in the construction of these transformers. The compound used is run in under vacuum, the coils having previously been thoroughly dried out. At ordinary air temperatures this compound remains perfectly solid, whilst at temperatures such as those due to the heating of the coils of the transformer, it assumes a more or less liquid state. The transformers are delivered with the compound filled in, and there is, therefore, no possibility of the coils taking up moisture during transit. Thus, this form of insulation possesses the advantages of oil insulation, whilst it avoids several of the troubles incidental to the use of oil.

THE DRIVING OF ROLLING MILLS.

An interesting comparison between electrically and steam-driven reversible rolling mills is drawn by Herr Philipi in the *E.T.Z.* for February 18th. The electrical installation considered is that of the Siemens-Schuckertwerke at the Georgs-Marienhütte. The steam-driven mill is that of the Röchling Eisen und Stahlwerke.

The electrically driven mill has rolls 35½ in. in diameter and 89 in. long, and was originally intended to deal with blocks 18 in. × 20 in., weighing about 5,500 lb., but has been found capable of handling blocks of double this weight. The upper roll is driven directly, through a coupling, by a shunt-wound direct-current double motor, consisting of two separate machines coupled together. In order to avoid dust, the motor is enclosed in a separate compartment.

The motor can develop a torque of 85,000 metre-kilogrammes (610,000 lb.-ft.), which, at the normal speed of 60 r.p.m., means, approximately, 7,000 h.p. A momentary overload of 30 per cent. to 50 per cent. is also obtainable.

The speed of the motor is regulated on the Ilgner system by altering the supply voltage. The supply is obtained from a motor-generator set fitted with a fly-wheel weighing 35 tons. This set consists of four machines in line, one of which acts as the driving motor and the three others as generators. All four machines are wound for 500 volts, so that the three generators in series produce sufficient pressure for the double motor, each half of which is wound for 750 volts. The speed of the motor-generator set fluctuates between between 350 and 450 r.p.m., and the motor part can develop a maximum of 1,300 h.p., corresponding to a generator output of about 800 kw., which, in combination with the fly-wheel effect, is sufficient to drive the double motor, although this develops as much as 10,000 h.p. on occasions. The motor of the motor-generator set is supplied from generators driven by large gas engines working with blast-furnace gas.

A current relay is inserted in the leads to the motor of the motor-generator set, and this automatically adjusts the field current of the motor, so as to maintain the current at the value corresponding to the average load on the rolling mill. This relay can be set to suit currents between the limits of 700 amperes and 1,600 amperes.

By means of a special device the speed at which the fields of the dynamos (on which the speed of the rolling mill motor depends) can be varied is increased, so that the reversals of the motor, from + 60 r.p.m. to — 60 r.p.m. can be carried out as many as 28 times in the minute with the rolling mill unloaded—a speed which far exceeds the requirements in practice.

Accurate tests were taken with this plant, both with regard to the power taken by the motor-generator set and to the size and kind of material dealt with in the rolls. The blocks dealt with weighed from 5,000 lb. to 6,000 lb., and measured 20 in. × 20 in. at the top, and 18 in. × 18 in. at the bottom, and were rolled out to sizes varying from 10½ in. × 10½ in. to 4 in. × 4 in., *i.e.*, the blocks are lengthened to from 3 to 21 times the original length.

The curves resulting from these tests are shown in fig. 1, where *a* gives the normal production in tons per hour, *b* gives the total consumption in kw. at normal production, *c* gives the specific energy consumption in kw.-hours per ton at the normal rate of production, and curve *d* gives, for the sake of comparison, the corresponding figures published by Köttgen for the Gutehoffnungshütte plant. The difference between *d* and *c* is accounted for by the unexpectedly high efficiency attained in the case of the Georgs-Marienhütte. The over-all efficiency of the electrical machinery in this plant in relation to the rate of production stated as a per cent. of the maximum rate of production is shown in fig. 2—*a* and *b* showing respectively the highest and lowest values obtained on test.

Turning to figures for the steam-driven rolling mill of the Röchling Eisen und Stahlwerke, it appears that the steam consumption per ton for an 8·1 fold extension of the block was 395 lb., for an 11·9 fold extension 480 lb., and for a 17·85 fold extension 615 lb. The electrical plant for the same three extensions requires 17 kw.-hours, 22 kw.-hours and 26-kw. hours which, with a modern steam turbine generating plant taking about 16½ lb. of steam per kw.-hour, means a consumption of 280, 366 and 430 lb. of steam per ton.

So that even on the basis of actual consumption the electrical plant is well in advance, and it has the further advantages of (1) greatly reduced upkeep expenses at week-ends and other periods of cessation or reduction of work, and of (2) being able to employ the existing supply of blast furnace gas by means of gas engines—such engines not being suitable for direct application to rolling mill work.

This latter point alone would, in the case of most large works, give an overwhelming advantage to the electrical plant.

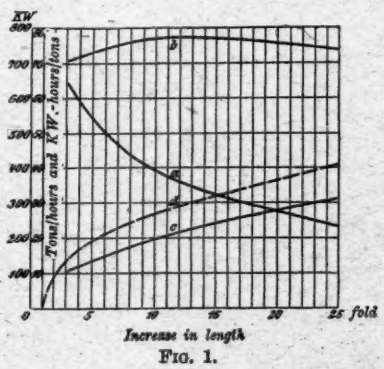


Fig. 1.

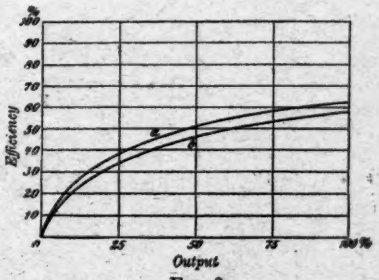


Fig. 2.

Test Curves of Electrically-driven Rolling Mills.

Where Should He Hold It?—In a well-known electrical engineering works, the manager was quite recently walking through the shop, and passed an apprentice engaged in chipping a casting. Noticing that the lad was holding his hammer close up to the head end, he stopped and asked the lad to lend him the hammer. The youth complied, and the manager then said, "My boy, when a man uses a hammer thus (holding it near the end of the handle) we pay him 38s. per week, but when he uses it thus (holding it near the head end), we only pay him 18s. per week." He then handed the hammer back to the apprentice, who, however, continued to use the hammer as before. The manager again borrowed the hammer and repeated his remarks and demonstration, and on again handing the hammer to the lad, said, "Do you see what I mean?" The lad, however, instead of going on with his work, looked first at the hammer, then at the work, then back at the hammer. The manager, thinking that perhaps the boy had still not quite understood his meaning, said, "Don't you understand what I mean, my boy?" "Oh, yes, sir," replied the boy; "but I was wonderin where I ought to hold it for 3s. a week."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CEYLON.—The value on which *ad valorem* duties are levied is the wholesale cash price, less trade discount, for which goods of the like kind and quality are sold, or are capable of being sold, at the time and place of importation, without any abatement or deduction whatever except of the amount of duties payable on the importation thereof. If such price is not ascertainable the value for duty-paying purposes will be the cost at which goods of the like kind and quality could be delivered at the place of importation without any abatement or deduction except of the import duties payable. If the goods are undervalued by the proprietor they will be confiscated, the proprietor receiving their valuation as entered by him in full satisfaction for the same.

The following are the duties fixed for electrical and similar materials:—

Rupee = 1s. 4d.

Asphalt, per ton	2·50 rupees
Brass, blocks, bars, wire and tubes, per cwt. ...	5 "
Copper bars, bolts, plates, wire, tubes, &c., per cwt.	5 "
Iron and steel (galvanised) goods of all descriptions, per cwt.	·75 "
Iron and steel (not galvanised): chains, wire, rivets, screws, &c., per cwt.	·63 "

The following are free:—Instruments—scientific, surgical, mathematical, &c.; motor trailers; all unwrought metals; channel bars, angles, plates, sheets and joists of iron or steel, but not galvanised iron; brass, copper, and yellow metal sheets and ingots; lead sheet, pipe, and pig and lead wire; cast steel; blister steel; tin plates; rails, rail fastenings, tie rods, fish-plates and turntables; stores imported for the use of the Government. Machinery, viz., prime movers and component parts thereof, including boilers, locomotive and portable engines, machines in which the prime mover is not separable from the operative parts, except motor-cars not used for traction; practically all machines worked by steam or other power, or which before being brought into use require to be fixed with reference to other moving parts, including those for foundries and workshops of iron and other metals; for mining, navigation, agriculture and pumping; for electric traction and electric lighting, &c.

Other electrical and similar materials ... ... 5½% ad val.

Note.—It is provided that the term "machinery" does not include tools and implements to be worked by manual or animal labour; also that only such articles shall be admitted as component parts of machinery as are indispensable for the working of the machinery, and are, owing to their shape or to other special quality, not adapted for any other purpose.

Machinery and component parts thereof made of substances other than metal are included under the above entry.

No person may establish or use any apparatus or installation for transmitting or receiving messages by means of wireless telegraphy unless a licence has been granted for that purpose by the Governor.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,450. "Improvements in electric accumulator sub-stations." A. M. Taylor. March 29th.

7,471. "Improvements in or relating to electric arc lamps." H. J. J. Jaburg, jun. (Date applied for under Sec. 91 of the Act, March 28th, 1908, being date of application in Germany.) March 29th. (Complete.)

7,508. "Apparatus for regulating the feed of carbons in arc lamps." M. Wittgensteiner. March 29th. (Complete.)

7,531. "Improvements in machines for covering wire or other electric conductors with insulating material." H. L. Owen. March 29th. (Complete.)

7,532. "Improvements in machines for covering wire or electric conductors with an insulating material." H. L. Owen. March 29th. (Complete.)

7,593. "Improvements in or relating to the connecting or jointing of electrical conductors and to means therefor." H. W. Handcock, A. H. Dykes and J. J. Rawlings. March 30th.

7,594. "Multi-lamps." T. Halfpenny. March 30th.

7,595. "Improved system and method of producing electric current by means of combustion engines." W. T. Müller. (Date applied for under Sec. 91 of the Act, April 6th, 1908, being date of application in Germany.) March 30th, (Complete.)

7,600. "Improvements relating to electric motor starters, electro-magnetic circuit-breakers and automatic switches." C. W. Denny. March 30th.

7,610. "Improvements in electric wire supports." C. C. Gould. March 30th. (Complete.)

7,616. "Improvements in and relating to protective devices for electric distributing systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 30th.

7,630. "Improvements in transformers for operating vapour electric apparatus." F. Conrad. (Date applied for under Sec. 91 of the Act, April 10th, 1908, being date of application in United States.) March 30th. (Complete.)

7,631 "Improvements in apparatus for use in producing multiple records of telephonic messages, sales, and the like." March 30th.

7,635. "Improved electrical rail bond." W. Leder. (Date applied for under Sec. 91 of the Act, June 6th, 1908, being date of application in Switzerland.) March 30th. (Complete.)

7,703. "Improvements in or relating to devices for forming connections with electrical conductors." H. W. Handcock, A. H. Dykes and J. J. Rawlings. March 31st.

7,706. "Improvements in and relating to armoured conductors for portable electric appliances." W. Schmahl and Armorduct Manufacturing Co., Ltd. March 31st.

7,741. "Improvements in or relating to operating devices for electric switches." A. T. Ytterberg. March 31st.

7,789. "Improved process of preventing oxidation caused when soldering or welding metallic wires and metallic filaments." A. Wenck and M. Ehrhardt. April 1st. (Complete.)

7,791. "Improvements in or relating to electric conductors." R. K. Gray. April 1st.

7,795. "Improvements in trolley frogs and crossings." F. J. Venning. Date applied for under Sec. 91 of the Act, April 15th, 1908, being date of application in United States.) April 1st. (Complete.)

7,805. "Improved combined electric switch and plug." H. S. Burton. April 1st.

7,827. "Improvements in electrical ignition devices for gas lamps and the like." J. Keith and G. Keith. April 1st.

7,838. "Improvements in alkaline accumulator." Nya Ackumulator Aktiebolaget Jungner and A. T. K. Estelle. April 1st. (Complete.)

7,843. "Improvements in and relating to incandescent electric lamps." H. Septon-Jones. (Julius Pintsch A.-G., Germany.) April 1st. (Complete.)

7,906. "Improvements in diaphragm condensers, especially adapted for the purpose of wireless telephony." W. Burstyn. (Date applied for under Sec. 91 of the Act, April 3rd, 1908, being date of application in Germany.) April 2nd. (Complete.)

7,913. "Improvements in electric glow lamps." F. Farber. April 2nd. (Complete.)

7,926. "Improvements in and relating to mariners' compasses." J. C. Dobbie. (Application for Patent of Addition to No. 19,224/07.) April 2nd. (Complete.)

7,993. "Improvements in or in connection with electrical switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. (Application for Patent of Addition to No. 6,899/07.) April 3rd. (Complete.)

7,995. "Improved system of and apparatus for wiring buildings and the like for the distribution of electricity." Simplex Conduits, Ltd., and L. W. Waterhouse. April 3rd.

8,014. "Improved electric incandescent lamp." H. T. Halfpenny. April 3rd.

8,024. "Improved switch for opening or closing electric circuits." O. Baker. April 3rd.

8,025. "New mechanical movement and special application thereof to electric switches." O. Baker. April 3rd. (Complete.)

8,068. "Improved means for preventing the corrosion of the internal parts of boilers due to electro-chemical action." P. E. G. Cumberland. April 3rd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Connections for Electric Batteries. New Ignition Syndicate, Ltd., F. J. Rouse and W. J. L. Sandy. 11,610. May 28th.

Luminous Electric Lighting and Bell Switches. E. C. Conradi. 12,225. June 5th.

Electromagnetic Relays Especially Applicable to the Control of Electric Motors. British Thomson-Houston Co. (General Electric Co., United States.) 12,684. June 12th. (Application for Patent of Addition to No. 16,195 of 1906.)

Electrically-Controlled Gas Valves. P. Benard. 13,772. June 29th.

Apparatus for Electrically Controlling Mechanism at a Distance. C. G. Lohay. 14,481. July 7th.

Searchlights or Projectors. Siemens Bros. Dynamo Works and R. Grimston. 14,657. July 10th.

Manufacture of Electric Incandescent Lamp Filaments. British Thomson-Houston Co. (General Electric Co., United States.) 14,867. July 13th.

Electric Telegraphs Particularly Applicable to Fire-Alarms. Siemens and Halske Akt.-Ges. 16,446. August 5th. (Date applied for under International Convention, August 5th, 1907.)

Electric Driving Mechanism for Clockwork. F. C. Webber. 16,701. August 8th.

Distributors for Electrical Ignition Systems for Automobiles. A. J. Cleveland. (T. A. Backe.) 17,083. August 18th.

Electric Relay Apparatus for the Safe Working of Railways. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 17,248. August 18th.

Method of Producing High-Frequency Currents and Apparatus Therefor. R. Goldschmidt. 17,835. August 25th.

Process of Sealing the Filament Carrier into the Bulb of Electric Incandescent Lamps. J. Kremenezky. 18,278. August 31st.

Electric Protective Devices of the Type known as Lightning Arresters. British Thomson-Houston Co. (General Electric Co., United States.) 18,619. September 4th.

Selectors for Automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 19,309. September 14th.

Thermally-Actuated Electric Switches. R. Dickson. 19,906. September 22nd.

Wireless Communication. L. de Forest. 20,206. September 25th.

Vacuous Electric Incandescence Lamps having Metallic Filaments. Siemens and Halske Akt.-Ges. 21,385. October 9th. (Date applied for under International Convention, November 2nd, 1907.)

Electrical Circuit Closer. R. D. Tiffany. 22,210. October 20th.

Radiometers. A. Larsson and T. Svalling. 22,915. November 9th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 24,890. November 12th.

Systems of Electrical Distribution. R. P. Jackson. 26,120. December 3rd.

Choke Coils. H. J. Beck. 26,165. December 3rd.

Systems of Electric Motor Control. H. C. Soule. 28,017. December 23rd. (Date applied for under International Convention, January 10th, 1908.)

Electric Accumulators. C. P. Ellison. 333. January 6th.

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Starting Switches for Alternating-Current Electric Motors. Siemens Bros. Dynamo Works and E. Schupp. 381. January 6th.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,851. February 5th.